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Endangered Species Act - Section 7
Consultation

BIOLOGICAL OPINION

IMPACTS OF THE INTERIM MANAGEMENT AGREEMENT FOR UPRIVER SPRING CHINOOK, SUMMER CHINOOK, AND SOCKEYE ON SALMON AND STEELHEAD LISTED UNDER THE ENDANGERED SPECIES ACT

Agency: Bureau of Indian Affairs
National Marine Fisheries Service, Northwest Region
US Fish and Wildlife Service

Consultation Conducted By: National Marine Fisheries Service

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1.0 INTRODUCTION

The National Marine Fisheries Service (NMFS) is required under section 7 of the Endangered Species Act (ESA) to conduct consultations which consider the impacts of federal actions on proposed fisheries on salmon species listed under the ESA. The objective of this biological opinion is to determine whether proposed fisheries conducted during the winter/spring/summer seasons in the Columbia River Basin subject to the terms of the Interim Management Agreement for Upriver Spring Chinook, Summer Chinook, and Sockeye (subsequently referred to as the Agreement) are likely to jeopardize the continued existence of chinook or sockeye salmon or steelhead listed under the ESA, or result in the destruction or adverse modification of their critical habitat.

2.0 CONSULTATION HISTORY

Fisheries in the Columbia River Basin were managed subject to provisions of the Columbia River Fish Management Plan (CRFMP) from 1988 through July 1999. The CRFMP was a stipulated agreement adopted by the Federal Court under the continuing jurisdiction of U.S. v Oregon. NMFS has provided consultation under section 7 of the ESA on proposed fisheries in the Columbia Basin since 1992. The Technical Advisory Committee (TAC) of U.S. v Oregon routinely prepared biological assessments for proposed fisheries that were submitted to NMFS through the U.S. Fish and Wildlife Service (USFWS). The TAC biological assessments considered treaty Indian and non-Indian fisheries within the jurisdiction of the CRFMP (with the exception of Idaho State fisheries in the Snake River Basin which were considered separately under section 10 of the ESA).

Winter, spring, and summer season fisheries in the Columbia River were managed from 1996 to 1998 under provisions of the 1996-1998 Management Agreement for Upper Columbia River Spring Chinook, Summer Chinook and Sockeye. The Management Agreement modified provisions of the CRFMP to include additional provisions for listed species. NMFS issued a Biological Opinion covering winter, spring, and summer season fisheries under the terms of the three year agreement (NMFS 1996a). NMFS then reinitiated consultation in 1998 to consider additional management measures for the protection of newly listed steelhead species and issued a revised Opinion that covered fisheries in 1998 (NMFS 1998a,b).

The CRFMP and thus the associated Management Agreement expired by their own terms on December 31, 1998, but were extended by agreement of the parties and court order through July 31, 1999. The 1999 winter, spring, and summer season fisheries were then subject to an additional consultation (NMFS 1999a). Although the U.S. v. Oregon parties have been engaged in negotiating a replacement for the CRFMP, no further extensions of the current Plan are anticipated in the near future. Absent the CRFMP the federal action or actions underlying the fisheries that provide the nexus for consultation under section 7 must be reconsidered.

NMFS advised the states of Oregon and Washington that with the expiration of the CRFMP in 1999, absent agreement among the U.S. v. Oregon parties, there was no federal nexus that provided for consideration of the state fisheries under section 7 of the ESA (Stelle 1999).

Although the States asserted that there was sufficient federal authority to provide for section 7 consultation (Greer and Koenings 1999), they nonetheless applied for a permit to incidentally take listed species, pursuant to section 10(a)(1)(B) of the ESA, to cover the suite of state winter, spring, and summer season fisheries for 2000 that had previously been considered as part of the joint state/tribal proposal under the jurisdiction of the Plan. In 2000, tribal fisheries were proposed by the Bureau of Indian Affairs on behalf of the tribes and, as a proposed federal action, were considered directly through section 7 of the ESA. State and tribal fishery proposals were grouped into a single biological opinion for efficiency and in compliance with the regulatory language of section 7 which allows NMFS to group a number of similar, individual actions within a given geographic area or segment of a comprehensive plan (50 CFR 402.14(c)). Because the state and tribal fisheries operate concurrently, are managed under coordinated programs, and impact the same listed species, they fulfill this regulatory standard.

For the year 2001, the BIA again provided a biological assessment on behalf of the four Columbia River tribes describing proposed tribal fisheries for 2001 (Speaks 2000). The States applied for a permit to incidentally take listed species, pursuant to section 10(a)(1)(B) of the ESA, to cover the suite of state winter, spring, and summer season fisheries for 2001 (Tweit and Norman 2000). Initially, the state and tribal fisheries were analyzed separately using the section 7 and 10 processes. However, prior to completion of the consultation, the states of Oregon and Washington, the four Columbia River tribes, and the federal parties to U.S. v Oregon resolved the outstanding issues and concluded an Interim Agreement regarding management of winter, spring, and summer season fisheries. Some elements of the Agreement will be in effect for three years. The parties committed to using a harvest rate schedule that applies to upriver spring chinook for the next five years. This Agreement among the state, tribal, and federal parties provides a nexus for NMFS' consideration of the combined state and tribal fisheries through a single section 7 consultation.

The key feature of the Agreement is an abundance based harvest rate schedule that defines allowable harvest rates for listed Snake River (SR) and Upper Columbia River (UCR) spring chinook stocks based on a sliding scale of abundance. The Agreement also sets specific harvest rate limits for SR summer chinook and sockeye. The states' permit application and the tribes' biological assessment continue to provide much of the necessary descriptive information regarding the scope of fisheries considered in this biological opinion. The Agreement therefore supplements the biological assessment and permit application, but also takes precedence where inconsistencies occur.

Additionally, the states of Oregon and Washington provided some further clarification regarding the scope of proposed state fisheries. First, they added the potential for a selective recreational fishery in the lower Snake River. Second, since the permit application was originally submitted, the states have now secured the necessary funding to further the development and implementation of selective fishery techniques that are designed to minimize impacts to listed fish. This will allow the states to implement a selective commercial fishery and use some of the funding to evaluate the effectiveness of the gears and the short-term effect on unmarked fish that are released as proposed in their permit application. Marked fish caught in the fishery will be retained by the fishermen. There are also three research components designed to test the effectiveness of a floating trap, optimal soak time and differential mortality associated with conventional gillnets and small mesh tooth nets, and the delayed mortality of fish that are caught and released when using tooth nets. All fish caught during the research projects will be marked and released. The states anticipated in their permit application that some selective fishery evaluation work would occur this year, but have recently confirmed their intentions and elaborated on these activities (Joint Staff 2001, Anonymous undated). NMFS expects that there will be similar research related to the furtherance of selective fishery implementation in future years and therefore considers research activities such as those proposed this year by the states, generally, as part of this consultation.

Finally, the circumstances related to the review and approval of freshwater fisheries affecting UWR spring chinook have recently changed. Harvest impacts to UWR spring chinook in mainstem fisheries were previously considered as part of the winter, spring, and summer season fishery consultation. However, ODFW recently submitted a Fishery Management and Evaluation Plan (FMEP) pursuant to the 4(d) Rule (65 FR 42422) that covers the expected take associated with all state mainstem and tributary fisheries. NMFS completed its review of the FMEP and determined that it adequately addresses all of the associated criteria (Darm 2001). Take prohibitions under section 9 of the ESA and applicable 4(d) rule therefore do not apply to fisheries, including those in the mainstem, that are managed consistent with the provisions of the FMEP.

The only remaining fishery included in the proposed action considered in this opinion is the tribes' dip net fishery at Willamette Falls which does affect on UWR spring chinook when it occurs. The effects of state and tribal fisheries to UWR spring chinook are considered in this opinion, but conclusions are limited to those related to only the tribal fishery.

3.0 BIOLOGICAL OPINION

3.1 Proposed Action

The proposed action is the intention of the Federal parties to U.S. vs Oregon to enter into an Interim Management Agreement with the non-Federal parties to the case regarding the management of winter, spring, and summer season fisheries in the Columbia River Basin. The fisheries considered in this Biological Opinion include winter, spring, and summer season fisheries in the Columbia River Basin as proposed by the Columbia River treaty tribes (the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, and the Confederated Tribes and Bands of the Yakama Indian Nation) (Speaks 2000). The proposed fisheries would occur primarily between January 1 and July 31, as described generally in the tribes' biological assessment and consistent with the terms of the Interim Agreement. The proposed action includes all treaty Indian Columbia River mainstem and tributary fisheries (with the exception of those in the Snake River Basin) between Bonneville and Wanapum Dams.

Also considered in this Opinion are non-Indian fisheries proposed by the states of Oregon and Washington that would occur primarily between January 1 and July 31, in the Columbia River mainstem from its mouth to Priest Rapids Dam and up to the Washington/Idaho border on the Snake River (Tweit and Norman 2000). The fisheries would also be managed as described generally in the states' section 10 permit application and consistent with the terms of the Interim Agreement. The specific fisheries considered are listed in Table 1.

Also considered in this consultation are research, monitoring, and evaluation activities associated with the fisheries that are necessary to minimize anticipated incidental take resulting from implementation of selective fisheries. The Federal Caucus's Basin-Wide Salmon Recovery Strategy (generally referred to as the All-H Paper) recommends implementation of an aggressive program to further develop selective fisheries strategies which are designed, in part, to reduce impacts on listed ESUs. The recent Biological Opinion related to the FCRPS (NMFS 2000a) contains specific Actions (Actions 164 and 167) in the Reasonable and Prudent Alternative that require the action agencies to develop, test, and deploy selective fishing methods and gear, and develop better estimates of incidental mortalities associated with selective fisheries. The states of Oregon and Washington have proposed specific research activities that would be carried out in conjunction with the 2001 fisheries. However, because this is a multi-year consultation, NMFS will also consider research activities that are likely to occur in future years and that are designed to meet the objectives of Actions 164 and 167.

The duration of the action considered here requires clarification. The states and tribes originally proposed fisheries for the 2001 season. The Interim Agreement that was negotiated extended the duration of the proposed fisheries, but its applicability varies. In most respects, the Interim Agreement expires after December 2003. However, the parties agreed to manage spring chinook fisheries subject to the total harvest rate limits defined in the Agreement through 2005. The spring chinook fishery limits were the key harvest issue in the negotiation and associated consultation. Harvest rate limits for other ESUs including summer chinook, sockeye, and steelhead were essentially carried over without change from past Agreements.

The intent of the parties at this time is to complete a revised CRFMP prior to the end of 2003. If that occurs, NMFS would reinitiate consultation to consider the revised Plan. If a new Plan is not completed by 2003, key terms of the Interim Agreement with respect to the management of spring chinook would continue to apply through 2005. NMFS presumes that limits for other ESUs (e.g., summer chinook, steelhead, sockeye) would continue to apply as well since they represent status quo conditions that have not been debated or modified in recent years. If there is no Plan even after 2005, it is reasonable to assume that fisheries would still be managed consistent with the terms of the Agreement. As a result, this consultation applies to future fisheries so long as they are managed subject to the terms of the Interim Agreement and current fishery proposals. If fisheries are proposed in the future that are inconsistent with these expectations, NMFS will reinitiate consultation.

3.2 Action Area

For purposes of this Biological Opinion, the action area encompasses the Columbia River and its tributaries from its mouth upstream to the Wanapum Dam, and in the Snake River up to the Washington/Idaho border.

Table 1. Proposed Columbia River non-Indian commercial and recreational and treaty Indian winter, spring, and summer season fisheries considered in this biological opinion.
Non-Indian Fisheries
Commercial Fisheries
Winter commercial sturgeon fishery
Winter commercial salmon fishery
Experimental commercial salmon fisheries - Tooth Net
Commercial spring chinook fishery — Select Area
Smelt commercial fishery/test fishery
Commercial anchovy and herring bait fishery
Area 2S commercial (non-Indian) shad fishery
Washougal Reef commercial (non-Indian) shad fishery
Sockeye commercial fishery
Recreational Fisheries
Spring chinook recreational fishery — mainstem Columbia River
Spring chinook recreational fishery — mainstem Snake River
Spring chinook recreational fishery —Select Area
Steelhead recreational fishery — mainstem Columbia River
Spring chinook/steelhead recreational fishery — Ringold
Recreational smelt fishery
Recreational shad fishery
Sockeye recreational fishery
Sturgeon recreational fishery
Warmwater recreational fishery
Test and assessment fisheries
Sturgeon tagging stock assessment
Research related to the effects of selective fishing gear
Non-Treaty Indian Subsistence Fisheries
Spring chinook Indian subsistence fishery - Wanapum Tribe
Treaty Indian Subsistence Fisheries
Commercial winter season gillnet fishery
Spring and summer season commercial and C&S mainstem fisheries
Commercial shad fisheries
Tributary fisheries
Willamette
Klickitat
Wind, White Salmon, Drano Lake, Deschutes, Yakima, Ringold, Icicle, Umatilla, John Day†
C&S and commercial (dipnet) smelt fisheries†
Commercial sturgeon set line fishery†

† No anticipated impacts to listed salmonids (indicated in *italics*)

4.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

A summary of all salmonid ESUs from the Columbia River basin currently listed under the ESA is shown in Table 2. Because of the timing of the proposed fisheries, Snake River fall chinook and Columbia River chum salmon will not be affected.

Table 2. Summary of salmonid species from the Columbia River Basin listed under the Endangered Species Act. Those shown in bold are potentially affected by the proposed actions.

Species	ESU	Status	Federal Register
Chinook Salmon (*O. tshawytscha*)	Snake River Fall **Snake River Spring/Summer** **Lower Columbia River** **Upper Willamette River** **Upper Columbia River Spring**	Threatened Threatened Threatened Threatened Endangered	57 FR 14653 4/22/92 57 FR 14653 4/22/92 64 FR 14308 3/24/99 64 FR 14308 3/24/99 64 FR 14308 3/24/99
Chum Salmon (*O. keta*)	Columbia River	Threatened	64 FR 14570 3/25/99
Sockeye Salmon (*O. nerka*)	**Snake River**	Endangered	56 FR 58619 11/20/91
Steelhead (*O. mykiss*)	**Upper Columbia River** **Snake River Basin** **Lower Columbia River** **Upper Willamette River** **Middle Columbia River**	Endangered Threatened Threatened Threatened Threatened	62 FR 43937 8/18/97 62 FR 43937 8/18/97 63 FR 13347 3/19/98 64 FR 14517 3/25/99 64 FR 14517 3/25/99

The ESUs that are subject to the highest harvest rates and that are most problematic due to their depressed status are Snake River (SR) spring/summer chinook, SR sockeye and Upper Columbia River (UCR) chinook. The effect of the proposed fisheries on Lower Columbia River (LCR) chinook and steelhead and Upper Willamette River (UWR) chinook and steelhead are relatively low, primarily because of their location in relation to the fisheries, the majority of which occur upstream of Bonneville Dam. The effect of the fisheries on UCR steelhead, Snake River Basin (SRB) steelhead, and Middle Columbia River (MCR) steelhead are limited because of the later return timing of summer run fish which are affected primarily in fall season fisheries. The following discussion and analysis therefore focuses on the limiting stocks in the existing management context (i.e. SR spring/summer chinook, SR sockeye and UCR chinook), although sufficient information regarding other listed ESUs is provided to explain the necessary conclusions of this opinion.

4.1 Species and Critical Habitat Description

4.1.1 Chinook Salmon

Snake River Spring/Summer Chinook Salmon

The SR spring/summer chinook ESU includes all natural-origin populations of spring/summer chinook in the Tucannon, Grande Ronde, Imnaha, and Salmon rivers. Some or all of the fish returning to several of the hatchery programs are also listed including those returning to the Tucannon, Imnaha, Grande Ronde Rivers and the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for SR spring/summer chinook salmon on December 28, 1993 (58 FR 68543) and was revised on October 25, 1999 (64 FR 57399).

Upper Columbia River Spring-Run Chinook Salmon

The UCR spring-run chinook salmon ESU includes all natural-origin, stream-type chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River basins. All chinook in the Okanogan River are apparently ocean-type and are considered part of the UCR summer- and fall-run ESU. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White rivers and Nason Creek. Critical habitat was designated for UCR spring-run chinook salmon on December 28, 1993 (58 FR 68543).

Upper Willamette River Chinook Salmon

The UWR chinook salmon ESU occupies the Willamette River and tributaries upstream of Willamette Falls, in addition to naturally produced spring-run fish in the Clackamas River. UWR spring chinook salmon is one of the most genetically distinct chinook groups in the Columbia River (CR) basin. Fall chinook salmon spawn in the upper Willamette but are not considered part of the ESU because they are not native. None of the hatchery populations in the Willamette River were listed, although five spring-run hatchery stocks were included in the ESU. Critical habitat was designated for UWR chinook salmon on February 16, 2000 (58 FR 68543).

Lower Columbia River Chinook Salmon

The LCR chinook salmon ESU includes all natural-origin populations of both spring- and fall-run chinook salmon in tributaries to the Columbia River from a transition point located east of Hood River, Oregon, and White Salmon River, Washington, to the mouth of the Columbia River at the Pacific Ocean and in the Willamette River below Willamette Falls, Oregon (excluding spring-run chinook salmon in the Clackamas River). Not included in this ESU are stream-type spring chinook salmon found in the Klickitat River (which are considered part of the Mid-Columbia River spring-run ESU) or the introduced Carson spring chinook salmon strain. Tule fall chinook salmon in the Wind and Little White Salmon rivers are included in this ESU, but not introduced upriver bright fall chinook salmon populations in the Wind, White Salmon, and Klickitat rivers. The Cowlitz, Kalama, Lewis, Washougal, and White Salmon rivers constitute the major systems on the Washington side; the lower Willamette and Sandy rivers are foremost on the Oregon side. Most of this ESU is represented by fall-run fish; there is some question whether any natural-origin spring chinook salmon persist in this ESU. Fourteen hatchery stocks were included in the ESU; one was considered essential for recovery (Cowlitz River spring chinook) but was not listed. Because of the timing of the fisheries, only the spring component of the ESU is affected by the proposed actions. Critical habitat was designated for LCR chinook salmon on February 16, 2000 (65 FR 7764).

4.1.2 Steelhead

Snake River Steelhead
The SR steelhead ESU includes all natural-origin populations of steelhead in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. None of the hatchery stocks in the Snake River basin is listed, but several are included in the ESU. Critical habitat was designated for SR steelhead on February 16, 2000 (65 FR 7764).

Upper Columbia River Steelhead
The UCR steelhead ESU includes all natural-origin populations of steelhead in the Columbia River basin upstream from the Yakima River, Washington, to the U.S./Canada border. The Wells Hatchery stock is included among the listed populations. Critical habitat was designated for UCR steelhead on February 16, 2000 (65 FR 7764).

Middle Columbia River Steelhead
The MCR steelhead ESU includes all natural-origin populations in the Columbia River basin above the Wind River, Washington, and the Hood River, Oregon, including the Yakima River, Washington. This ESU includes the only populations of winter inland steelhead in the United States (in the Klickitat River, Washington, and Fifteenmile Creek, Oregon). Both the Deschutes River and Umatilla River hatchery stocks are included in the ESU, but are not listed. Critical habitat was designated for MCR steelhead on February 16, 2000 (65 FR 7764).

Lower Columbia River Steelhead
The LCR steelhead ESU consists of all natural-origin populations in tributaries to the Columbia River between the Cowlitz and Wind rivers, Washington, and the Willamette and Hood rivers, Oregon, inclusive. NMFS specifically excluded three river basins: the Willamette River basin above Willamette Falls, the Little White Salmon River, and the Big White Salmon River, Washington (61 FR 41545). Among hatchery stocks, late-spawning Cowlitz River Trout Hatchery and late-spawning Clackamas River ODFW stock #122 are part of the ESU, but are not listed. Critical habitat was designated for LCR steelhead on February 16, 2000 (65 FR 7764).

Upper Willamette River Steelhead
The UWR steelhead ESU consists of all natural-origin populations in the Willamette River and its tributaries upstream of Willamette Falls to the Calapooia River, inclusive. None of the hatchery stocks was included as part of the listed ESU. Critical habitat was designated for UWR steelhead on February 16, 2000 (65 FR 7764).

4.1.3 Sockeye Salmon

Snake River Sockeye Salmon
The SR sockeye salmon ESU includes populations of sockeye salmon from the Snake River basin, Idaho (extant populations occur only in the Salmon River subbasin). Under NMFS' interim policy on artificial propagation (58 FR 17573), the progeny of fish from a listed population that are propagated artificially are considered part of the listed species and are protected under ESA. Thus, although not specifically designated in the 1991 listing, SR sockeye

salmon produced in the captive broodstock program are included in the listed ESU. Given the dire status of the wild population under any criteria (16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000), NMFS considers the captive broodstock and its progeny essential for recovery. Critical habitat was designated for SR sockeye salmon on December 28, 1993 (58 FR 68543).

4.2 General Life Histories

General life history information is presented below for chinook salmon, steelhead, and sockeye salmon. More specific information regarding species status and recent population trends is provided separately for each ESU in the following section.

4.2.1 Chinook Salmon

Chinook salmon is the largest of the Pacific salmon. The species' distribution historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, combinations of seven total ages with three possible freshwater ages. This level of complexity is roughly comparable to that seen in sockeye salmon (O. nerka), although the latter species has a more extended freshwater residence period and uses different freshwater habitats (Miller and Brannon 1982, Burgner 1991). Gilbert (1912) initially described two generalized freshwater life-history types: "stream-type" chinook salmon, which reside in freshwater for a year or more following emergence, and "ocean-type" chinook salmon, which migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for ocean-type and stream-type to describe two distinct races of chinook salmon. Healey's approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations. For the purposes of this Opinion, those chinook salmon (spring and summer runs) that spawn upriver from the Cascade crest are generally stream-type; those which spawn downriver of the Cascade Crest (including in the Willamette River) are generally ocean-type.

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater; migration to the ocean; and the subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. The juvenile rearing period in freshwater can be minimal or extended. Additionally, some male chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Although salmon exhibit a high degree of variability in life-history traits, there is considerable debate regarding the degree to which this variability is shaped by local adaptation or results from the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991). More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

4.2.2 Steelhead

Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Some river basins have both summer and winter steelhead, whereas others only have one run type.

In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby et al. 1996, Nickelson et al. 1992a). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992a). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992a). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992a), migrate to spawning areas, and then spawn in late winter or spring. Some adults do not, however, enter coastal streams until spring, just before spawning (Meehan and Bjornn 1991). Difficult field conditions (snowmelt and high stream flows) and the remoteness of spawning grounds contribute to the relative lack of specific information on steelhead spawning.

Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992a). Iteroparity is more common among southern steelhead populations than northern populations (Busby et al. 1996). Multiple spawnings for steelhead range from 3% to 20% of runs in Oregon coastal streams.

Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Giger 1973) are required to reduce disturbance and predation of spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966, Behnke 1992).

Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992a).

Juveniles rear in freshwater from 1 to 4 years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after 2 years in freshwater (Busby et al. 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant (Busby et al. 1996). Age structure appears to be similar to other west coast steelhead, dominated by 4-year-old spawners (Busby et al. 1996).

Based on purse seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating along the coastal belt as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy et al. 1990, Pearcy 1992).

4.2.3 Sockeye Salmon

Snake River sockeye salmon adults enter the Columbia River primarily during June and July. Arrival at Redfish Lake, which now supports the only remaining run of Snake River sockeye salmon, peaks in August, and spawning occurs primarily in October (Bjornn et al. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean (Bell 1986). Migrants leave Redfish Lake during late April through May (Bjornn et al. 1968) and travel almost 900 miles to the Pacific Ocean. Smolts reaching the ocean remain inshore or within the influence of the Columbia River plume during the early summer months. Later, they migrate through the northeast Pacific Ocean (Hart 1973, Hart and Dell 1986). Snake River sockeye salmon usually spend 2 to 3 years in the Pacific Ocean and return in their fourth or fifth year of life. For detailed information on the Snake River sockeye salmon, see Waples et al. (1991).

4.3 Population Dynamics and Distribution

4.3.1 Chinook Salmon

Snake River Spring/Summer Chinook Salmon

The present range of spawning and rearing habitat for naturally spawned SR spring/summer chinook salmon is primarily limited to the Salmon, Grande Ronde, Imnaha, and Tucannon subbasins. Most SR spring/summer chinook salmon enter individual subbasins from May through September. Juvenile SR spring/summer chinook salmon emerge from spawning gravels from February through June (Perry and Bjornn 1991). Typically, after rearing in their nursery streams for about 1 year, smolts begin migrating seaward in April and May (Bugert et al. 1990, Cannamela 1992). After reaching the mouth of the Columbia River, spring/summer chinook salmon probably inhabit nearshore areas before beginning their northeast Pacific Ocean migration, which lasts 2 to 3 years. Because of their timing and ocean distribution, these stocks are subject to very little ocean harvest. For detailed information on the life history and stock status of SR spring/summer chinook salmon, see Matthews and Waples (1991), NMFS (1991), and 56 FR 29542 (June 27, 1991).

Bevan et al. (1994) estimated the number of wild adult SR spring/summer chinook salmon in the late 1800s to be more than 1.5 million fish annually. By the 1950s, the population had declined to an estimated 125,000 adults. Escapement estimates indicate that the population continued to decline through the 1970s. Returns varied through the 1980s, but have declined further in recent years. Record low returns were observed in 1994 and 1995. Dam counts were modestly higher from 1996 through 1998, but declined in 1999. For management purposes, the spring and summer chinook salmon in the Columbia River basin, including those returning to the Snake River, have been managed as separate stocks. Historical databases, therefore, provide separate estimates for the spring and summer chinook salmon components. Table 3 reports the estimated annual return of adult, natural-origin SR spring and summer chinook salmon returning to Lower Granite Dam since 1979.

NMFS established an escapement goal of 31,440 natural spawners at Lower Granite Dam (measured as an eight year geometric mean) as one of its interim recovery goals for SR spring/summer chinook (NMFS 1995a). The goal represents 60% of the 1962-1967 observed escapement at Ice Harbor Dam. Ice Harbor was the first dam built on the lower Snake River. The escapement at that time is believed to reflect a status that was generally healthy prior to the subsequent period of decline associated with further dam construction and other generally deteriorating conditions. The SR spring/summer chinook salmon ESU consists of 39 local spawning populations (subpopulations) spread over a large geographic area (Lichatowich et al. 1993). The number of fish returning to Lower Granite Dam is, therefore, divided among these subpopulations. The relationships between these subpopulations, and particularly the degree to which individuals may intermix, are unknown.

It is unlikely that all 39 are independent populations per the definition in McElhany et al. (2000), which requires that each be isolated such that the exchange of individuals between populations does not substantially affect population dynamics or extinction risk over a 100-year time frame. Nonetheless, monitoring the status of subpopulations provides more detailed information on the status of the species than would an aggregate measure of abundance.

Seven of these subpopulations have been used as index stocks to analyze extinction risk and alternative actions that may be taken to meet survival and recovery requirements. The Snake River Salmon Recovery Team selected these subpopulations primarily because of the availability of a relatively long-term series of abundance data. The BRWG developed recovery and threshold abundance levels for the index stocks, which serve as reference points for comparisons with observed escapements (Table 4). The threshold abundances represent levels at which uncertainties (and, thus, the likelihood of error) about processes or population enumeration are likely to be biologically significant and at which qualitative changes in processes are likely to occur. They were not developed as indicators of pseudo-extinction or as absolute indicators of critical thresholds. In any case, escapement estimates for the index stocks have generally been well below threshold levels in recent years (Table 4).

Table 3. Estimates of natural-origin SR spring/summer chinook salmon counted at Lower Granite. The interim recovery escapement level for the ESU is from (NMFS 1995a).

Year	Spring Chinook	Summer Chinook	Total
1979	2,573	2,714	5,287
1980	3,478	2,404	5,882
1981	7,941	2,739	10,680
1982	7,117	3,531	10,648
1983	6,181	3,219	9,400
1984	3,199	4,229	7,428
1985	5,245	2,696	7,941
1986	6,895	2,684	9,579
1987	7,883	1,855	9,738
1988	8,581	1,807	10,388
1989	3,029	2,299	5,328
1990	3,216	3,342	6,558
1991	2,206	2,967	5,173
1992	11,134	441	11,575
1993	5,871	4,082	9,953
1994	1,416	183	1,599
1995	745	343	1,088
1996	1,358	1,916	3,274
1997	2,126	5,137	7,263
1998	5,089	2,913	8,002
1999	1,335	1,584	2,919
2000	8,049	846	8,895
2001[1]	*17,700*	*2,400*	*20,100*
Recovery Esc Level			31,400

[1] *preseason estimate*

Table 4. Adult spawners for Snake River Spring/Summer chinook index stocks. Spring index stocks: Bear Valley, Marsh, Sulphur, and Minam. Summer index stocks: Poverty Flats and Johnson. Run-timing for the Imnaha stocks is intermediate.

Brood year	Bear Valley	Marsh	Sulphur	Minam	Imnaha	Poverty Flats	Johnson
1979	215	83	90	40	238	76	66
1980	42	16	12	43	183	163	55
1981	151	115	43	50	453	187	102
1982	83	71	17	104	590	192	93
1983	171	60	49	103	435	337	152
1984	137	100	0	101	557	220	36
1985	295	196	62	625	699	341	178
1986	224	171	385	357	479	233	129
1987	456	268	67	569	448	554	175
1988	1109	395	607	493	606	844	332
1989	91	80	43	197	203	261	103
1990	185	101	170	331	173	572	141
1991	181	72	213	189	251	538	151
1992	173	114	21	102	363	578	180
1993	709	216	263	267	1178	866	357
1994	33	9	0	22	115	209	50
1995	16	0	4	45	97	81	20
1996	56	18	23	233	219	135	49
1997	225	110	43	140	474	363	236
1998	372	164	140	122	159	396	119
1999	72	0	0	96	282	153	49
2000[1]	313	65	13	na	na	350	63
Recovery Levels	**900**	**450**	**300**	**450**	**850**	**850**	**300**
BRWG Threshold	**300**	**150**	**150**	**150**	**300**	**300**	**150**

[1] Preliminary post-season estimates

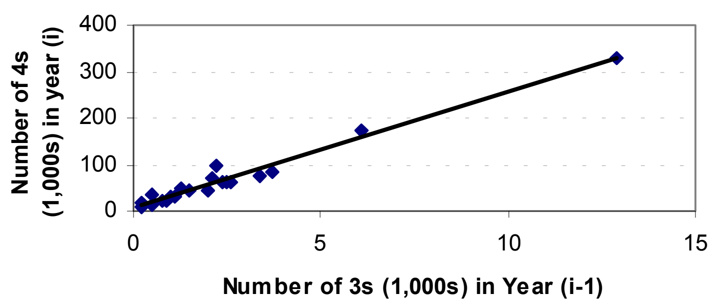
The final aggregate count for upriver spring chinook salmon at Bonneville Dam in 2000 was 178,659, substantially higher than the pre-season forecast of 134,000. This is the second highest return in 30 years (after the 1972 return of 179,300 adults). Although only a small portion of these fish were natural-origin spring chinook salmon destined for the Snake River (12,413), the estimate for natural-origin SR spring chinook salmon in 2000 was substantially higher than the contributing brood year escapements (comparable returns to the Columbia River mouth in 1995 and 1996 were 1,822 and 3,900, respectively).

The final aggregate count for the upriver summer chinook salmon stocks in 2000 was 30,651, which is, again, the second highest return in over 30 years, but only a small portion (886) were natural-origin fish destined for the Snake River. The return of natural-origin fish in 2000 was higher than brood year escapements in 1995 (496), but substantially lower than brood year escapements in 1996 (2,717), and substantially lower than the average returns over the last 5 years (3,061). Although the spring component of the ESU showed a strong return in 2000, the summer component did not. Even with near record return of spring chinook in 2000, escapement for index stocks remained at or below threshold abundance levels (see Table 4).

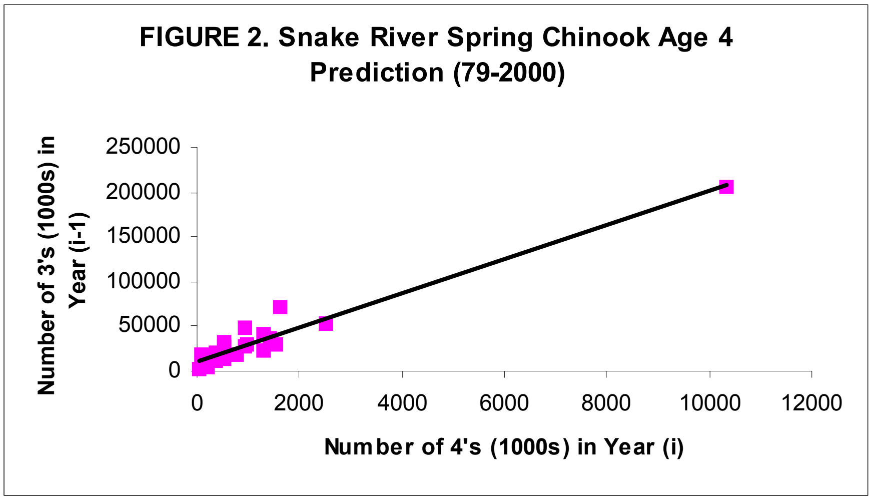
The 2001 forecast for the aggregate abundance of upriver spring chinook stocks is 364,600, which would be the highest return since counts began at Bonneville Dam in 1938. A relatively small portion of these are expected to be natural-origin spring chinook destined for the Snake River (39,300). This estimate for natural-origin SR spring chinook is, nonetheless, substantially higher than the contributing brood year escapements and over twice the size of any run since at least 1979 (Table 5). The comparable returns to the Columbia River mouth in 1996 and 1997 were 3,903 and 4,757, respectively. The 2000 Columbia River mouth return was 12,413.

It is appropriate to note that there is considerable uncertainty about the 2001 forecast of 364,600 for the aggregate abundance of upriver spring chinook. This forecast is derived by adding two point estimates; one estimate for age 4 fish and one for age 5 fish. Age 4 fish account for 91% of the expected return. The predictor for age 4 fish is based on a recent year (1982-2000) regression model relating age 3 to age 4 fish of the same brood. This regression has an r^2 value of 0.89 and yields a point estimate of 330,500 +/- 58,100 (Figure 1). The point estimate for age 4 fish in 2001 assumes a linear relationship between 3s at year (i-1) and 4s at year (i) that is well outside the range of observed values (Figure 1). If this assumption proves to be wrong, the actual 2001 return could be substantially less than predicted.

FIGURE 1. **Upriver Spring Chinook Age 4 Prediction (1982-2000)**



The Snake River wild forecast (39,300) is actually estimated from an average wild proportion of the expected total return of spring chinook to the Snake River (206,700). The Snake River return is calculated using a similar age-related regression, but the independent variable is again well outside the range of observations (Figure 2).



The regression analysis assumes that age 3 and age 4 fish are linearly related even given the unprecedented return of age 3 fish. Another plausible explanation for the dramatic increase in the number of age 3 upriver spring chinook counted in 2000 is that there was some sort of environmentally induced change in the maturation rate for that brood. If it is the maturation rates, rather than the survival rates, that are unusually high, the predicted return may be substantially in error.

Table 5. Columbia River Mouth Run Size For Aggregate Upriver, Snake River and Upper Columbia River Spring Chinook

Year	Columbia River Mouth Upriver Run Size	SnR Wild at River Mouth	UCR Wild at River Mouth
1979	48,703	7,785	10,010
1980	53,207	13,123	10,137
1981	63,766	14,934	13,456
1982	71,252	18,742	9,559
1983	57,826	14,433	9,170
1984	48,658	7,213	10,970
1985	86,498	8,264	17,146
1986	120,627	12,367	14,096
1987	100,164	12,248	13,186
1988	97,237	14,349	9,124
1989	83,402	6,985	8,756
1990	99,486	6,066	6,010
1991	59,883	5,447	2,771
1992	89,969	15,959	5,739
1993	111,758	7,801	7,494
1994	21,075	2,130	1,567
1995	10,197	1,822	704
1996	51,530	3,900	508
1997	114,124	4,757	2,175
1998	38,376	9,694	880
1999	38,700	3,032	1,355
2000	178,300	12,413	4,280
2001[1]	*364,600*	*39,300*	*6,300*

[1]Preseason Forecast

The 2001 Columbia River mouth forecast for the upriver summer chinook stocks is 24,500, with only a small portion (3,100) being natural-origin fish destined for the Snake River. The comparable returns to the Columbia River mouth in 1996 and 1997 were 2,717 and 5,533, respectively. The 2000 Columbia River mouth return was 30,651.

The probability of meeting survival and recovery objectives for SR spring/summer chinook salmon under various future operation scenarios for the hydrosystem was analyzed through a process referred to as PATH (Plan for Analyzing and Testing Hypotheses) (Marmorek et al. 1998) The scenarios analyzed focused on status quo management and options that emphasized either juvenile transportation or hydro-project drawdown. PATH also included sensitivity analyses to alternative harvest rates and habitat effects. PATH estimated the probability of survival and recovery for the seven index stocks using the recovery and escapement threshold levels as abundance indicators. The forward simulations estimated the probability of meeting the survival thresholds after 24 and 100 years.

A 70% probability of exceeding the threshold escapement levels was used to assess survival. Recovery potential was assessed by comparing the projected abundance to the recovery abundance levels after 48 years. A 50% probability of exceeding the recovery abundance levels was used to evaluate recovery by comparing the 8-year mean projected abundance. In general, the survival and recovery standards were met for operational scenarios involving drawdown, but were not met under status quo management or for the scenarios that relied on juvenile transportation (Marmorek et al. 1998). If the most conservative harvest rate schedule was assumed, transportation scenarios came very close to meeting the survival and recovery standards.

More recent analyses, generally referred to as the Cumulative Risk Initiative (CRI), have been developed by the NMFS' Northwest Regional Science Center. The CRI is designed to provide a standardize tool for assessing stock status and survival improvement necessary to meet survival and recovery objectives. For the SR spring/summer chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[1] ranges from 0.96 to 0.80, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to the effectiveness of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated median population growth rates and the risk of absolute extinction for the seven spring/summer chinook salmon index stocks,[2] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years for the wild component ranges from zero for Johnson Creek to 0.78 for the Imnaha River (Table B-5 in McClure et al. 2000a). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for Johnson Creek to 1.00 for the wild component in the Imnaha River (Table B-6 in McClure et al. 2000a).

In its recent biological opinion regarding the FCRPS, NMFS summarized the prospects for survival and recovery in terms of the estimated percent change in survival needed to achieve survival and recovery indicator criteria after implementing the hydro survival improvements of the Reasonable and Prudent Alternative (NMFS 2000a). These are then identified as the offsite mitigation performance standards for the FCRPS (see section 9.2.2.2.2 in NMFS 2000a). In

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[1]Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1999 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

[2] McClure et al. (2000b) have calculated population trend parameters for additional SR spring/summer chinook salmon stocks.

general, the low and high values in the table reflect uncertainty about the effectiveness of hatchery spawners in the wild, although the summary statistics do not reflect the full measure of uncertainty in the estimates. These estimates suggest that three of the seven SR spring/summer chinook index stocks require no additional survival changes beyond those expected through modification of the hydrosystem under the RPA to meet the survival and recovery indicator criteria. The other four index stocks require additional survival improvements ranging from 0 to 66% (Table 6). These survival improvements are expected to be achieved through offsite mitigation activities. Inherent in the overall analysis is the assumption that harvest impacts will remain at the levels reflected in the most recent biological opinions. Generally speaking, increases in the harvest rates, particularly over the long-term, will change these statistics and increase the level of survival improvements required in other sectors. Harvest increases, beyond those assumed, would otherwise simply reflect a further increase of risk to the species.

Table 6. Estimated percentage change (i.e., additional improvement in life-cycle survival) needed to achieve survival and recovery indicator criteria after implementing the hydro survival improvements in the RPA. (A value of 26, for example, indicates that the egg-to-adult survival rate, or any constituent life-stage survival rate, must be multiplied by a factor of 1.26 to meet the indicator criteria.)

Spawning Aggregation	**Needed survival Change**	
	Low	**High**
Snake River Spring/Summer		
Bear Valley/Elk Creeks	0	0
Imnaha River	26	66
Johnson Creek	0	0
Marsh Creek	0	12
Minam River	0	28
Poverty Flats	0	0
Sulphur Creek	0	5
Upper Columbia River Spring		
Methow River	24	90
Entiat River	32	119
Wenatchee River	51	178

Note: Low and High estimates are based on a range of assumptions, as described in the text.

Upper Columbia River Spring-Run Chinook Salmon

The UCR spring-run chinook salmon ESU inhabits tributaries upstream from the Yakima River to Chief Joseph Dam. UCR spring-run chinook salmon have a stream-type life history. Adults return to the Wenatchee River from late March through early May, and to the Entiat and Methow rivers from late March through June. Most adults return after spending 2 years in the ocean, although 20% to 40% return after 3 years at sea. Like SR spring/summer chinook salmon, UCR spring-run chinook salmon experience very little ocean harvest. Peak spawning for all three populations occurs from August to September. Smolts typically spend 1 year in freshwater before migrating downstream. There are slight genetic differences between this ESU and others containing stream-type fish, but more importantly, the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers et al. 1998). The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the upper Columbia region.

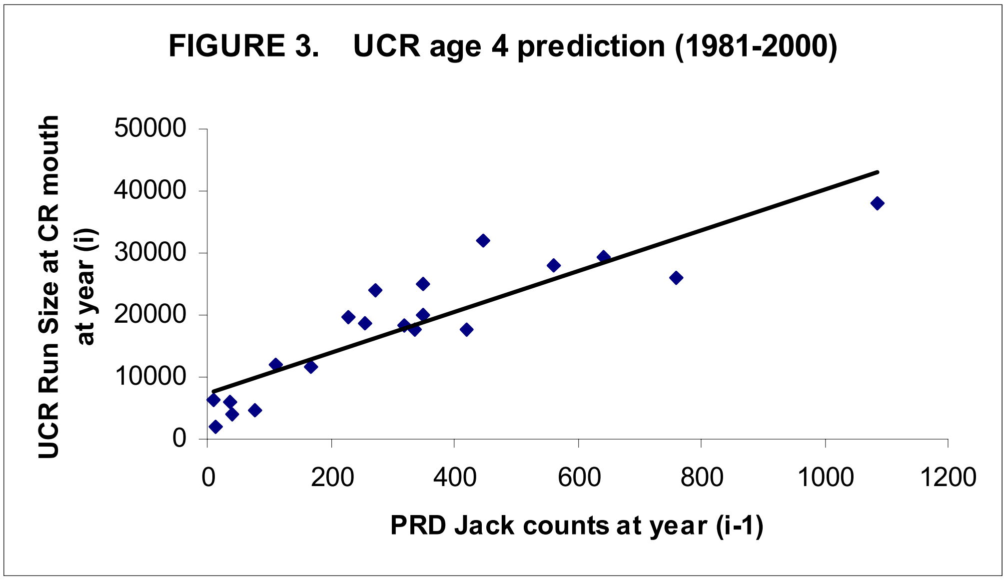
Three independent populations of spring-run chinook salmon are identified for the ESU including those that spawn in the Wenatchee, Entiat, and Methow basins (Ford et al. 1999). The number of natural-origin fish returning to each subbasin is shown in Table 7. NMFS recently proposed interim recovery abundance levels and cautionary levels (i.e., interim levels still under review and subject to change). Ford et al. (1999) characterize cautionary levels as abundance levels that the population fell below only about 10% of the time during a historical period when it was considered to be relatively healthy. Escapements for UCR spring-run chinook salmon have been substantially below the cautionary levels in recent years, especially during 1995, indicating increasing risk to and uncertainty about the population's future status. On the other hand, returns for 1999 and 2000, the primary return year for the 1995 and 1996 broods, indicate that although they were low, returns were generally higher than the contributing broodyears. Very strong 1999 and 2000 jack returns suggest that survival rates for the 1996 and 1997 brood were high, as well. A total of 4,280 natural-origin UCR spring-run chinook salmon returned to the mouth of the Columbia River during 2000. However, the corresponding returns to each subbasin (accounting for expected harvest, inter-dam loss, and prespawning mortality) were still at or substantially below their respective cautionary level (Table 7). The predicted return of natural-origin UCR spring chinook for 2001 is 6,300 adults at the mouth of the Columbia River. Given the predicted return, the expected return-to-subbasin for the populations, accounting for expected harvest, inter-dam loss, and prespawning mortality, would be about equivalent to the identified Cautionary Levels.

Table 7. Estimates of the number of natural-origin fish returning to the sub-basin for each of the identified UCR spring chinook populations and preliminary estimates for the Recovery Abundance and Cautionary Levels.

Year	Wenatchee River	Entiat River	Methow River
1979	1,154	241	554
1980	1,752	337	443
1981	1,740	302	408
1982	1,984	343	453
1983	3,610	296	747
1984	2,550	205	890
1985	4,939	297	1,035
1986	2,908	256	778
1987	2,003	120	1,497
1988	1,832	156	1,455
1989	1,503	54	1,217
1990	1,043	223	1,194
1991	604	62	586
1992	1,206	88	1,719
1993	1,127	265	1,496
1994	308	74	331
1995	50	6	33
1996	201	28	126
1997	422	69	247
1998	218	52	125
1999	119	64	73
2000[1]	489	175	<75
Recovery	**3,750**	**500**	**2,000**
Cautionary	**1,200**	**150**	**750**

[1] Preliminary post season estimates

It is appropriate to note that there is also uncertainty about the 2001 Columbia River mouth forecast of 38,100 for the aggregate abundance of UCR spring chinook. TAC derived this forecast by averaging two estimates: 1) A regression of Priest Rapids Dam age 3 fish (1981 on) versus total UCR run, with $r^2 = 0.77$ (Estimate= 47,069), and 2) A regression of the Log of Priest Rapids Dam age 3 versus total UCR run (1981 on), with $r^2 = 0.79$ (Estimate=29,057). The 2001



Upper Columbia Wild Spring Chinook forecast of 6,300 fish at Columbia River mouth was calculated using the 5 year average wild proportion (0.1646) of the Upper Columbia River run. The point estimate for age 4 fish in 2001 again assumes a linear relationship between 3s at year (i-1) and 4s at year (i) that is again outside the range of observed values (Figure 3). If this assumption proves to be wrong, the actual 2001 return could be substantially less than predicted.

Washington Department of Fish and Wildlife staff developed an alternative Columbia River mouth forecast for Upper Columbia Wild Spring Chinook based on redd counts in the contributing brood years for each basin, expanded to smolts and then multiplied by smolt-to-adult survival rates. The resulting river mouth run size estimates ranged from 2,249 to 4,130. These are low compared to the TAC estimate of 6,300. Although TAC has not reviewed this method, it reflects an alternative and generally a more conservative expectation of the return for 2001.

TAC uses Priest Rapids Dam as an index of the UCR wild return, but this index does not relate well to observed fish on the spawning grounds. The discrepancy may be related to significant additional losses that occur in passing by 3-5 more dams (depending on the population) or to fish that pass above but than fall back below the dams. The fall back phenomenon would lead to over estimates of fish assumed to pass above the dam. Priest Rapids Dam counts are at best an index of wild population abundance, but the resulting forecast overestimates wild population abundance relative to returns to the spawning grounds.

Six hatchery populations are included in the listed ESU; all six are considered essential for recovery. Recent artificial production programs for fishery enhancement and hydrosystem mitigation have been a concern because a non-native (Carson Hatchery) stock was used. However, programs have been initiated to develop locally adapted brood stocks to supplement natural populations. Facilities where problems with straying and interactions with natural stock are known to occur are phasing out use of Carson stock. Captive broodstock conservation programs are under way in Nason Creek and White River (the Wenatchee basin) and in the Twisp River (Methow basin) to prevent the extinction of those spawning populations. All spring chinook salmon passing Wells Dam in 1996 and 1998 were trapped and brought into the hatchery to begin a composite-stock broodstock supplementation program for the Methow basin.

For the UCR spring chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[3] ranges from 0.85 to 0.83, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated median population growth rates and the risk of absolute extinction for the three spawning populations identified by Ford et al. (1999), using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from 0.97 for the Methow River to 1.00 for the Methow and Entiat rivers (Table B-5 in McClure et al. 2000a). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of extinction within 100 years is 1.00 for all three spawning populations (Table B-6 in McClure et al. 2000a).

Table 6 summarized the prospects for survival and recovery in terms of the estimated percent change in survival needed to achieve survival and recovery indicator criteria after implementing the hydro survival improvements of the Reasonable and Prudent Alternative (NMFS 2000a). These are then identified as the offsite mitigation performance standards for the FCRPS (see section 9.2.2.2.2 in NMFS 2000a). In general, the low and high values in the table reflect uncertainty about the effectiveness of hatchery spawners in the wild, although the summary statistics does not reflect the full measure of uncertainty in the estimates. These estimates suggest that all three UCR spring chinook index stocks require significant additional survival changes beyond those expected through modification of the hydrosystem under the RPA to meet the survival and recovery indicator criteria. The three index stocks require additional survival improvements ranging from 24 to 178% (Table 6). These survival improvements are expected to be achieved through offsite mitigation activities. Inherent in the overall analysis is the assumption that harvest impacts will remain at the levels reflected in the most recent biological opinions. Generally speaking, increases in the harvest rates, particularly over the long-term, will change these statistics and increase the level of survival improvements required in other sectors. Harvest increases, beyond those assumed, would otherwise simply reflect a further increase of risk to the species.

<u>Upper Willamette River Chinook Salmon</u>

UWR chinook salmon are one of the most distinct groups in the Columbia basin — genetically, in terms of age structure, and in terms of their marine distribution (64 FR 14322). The narrow time window available for passage above Willamette Falls (at Willamette RKm 42) may have

[3] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

limited migratory access to the upper basin to spring periods of high flow (Howell et al. 1985), providing reproductive isolation and, thereby, defining the boundary of a distinct biogeographic region. Winter steelhead and spring chinook salmon were indigenous above the falls, but summer steelhead, fall chinook salmon, and coho salmon were not (Busby et al. 1996). Because the Willamette Valley was not glaciated during the last epoch (McPhail and Lindsey 1970), any reproductive isolation provided by the falls would have been uninterrupted for a considerable time, providing the potential for significant local adaptation relative to other Columbia basin populations.

The life history of chinook salmon in the Upper Willamette River ESU includes traits from both ocean- and stream-type development strategies: smolts emigrate both as young-of-the-year and as age-1 fish. Mattson (1962) reported three distinct migrations of juvenile spring chinook salmon in the lower Willamette River (Lake Oswego area), including movements of a given year class during late winter through spring (age-0 migrants; 40 to 100 mm), late fall-early winter (age-1 fish; 100 to 130 mm), and then during the following spring (age-2 fish; 100 to 140 mm). Smolt and fry migration patterns at Leaburg Dam in the McKenzie River appear to have shifted over the years; samples collected between 1948 and 1968 indicated that fry emigrated primarily during March through June (Howell et al. 1988) but now peak during January through April (earlier than in previous years) (Corps 2000). Distribution in the ocean is consistent with an ocean-type life history (most are caught off the coasts of British Columbia and Southeast Alaska).

Historically, five major basins produced spring chinook salmon: the Clackamas, North and South Santiam, McKenzie, and Middle Fork Willamette rivers. However, between 1952 and 1968, dams were built on all of the major tributaries occupied by spring chinook salmon, blocking over half of the most productive spawning and rearing habitat. Water management operations have also reduced habitat quality in downstream areas due to thermal effects (relatively warm water released during autumn leads to the early emergence of stream-type chinook salmon fry, and cold water released during spring reduces juvenile growth rates).

Spring chinook salmon on the Clackamas River were unable to reach the upper watershed after 1917, when the fish ladder washed out at Faraday Dam, but recolonized the system after 1939, when the ladder was repaired. NMFS has not been able to determine whether the recolonization of the Clackamas system was human-mediated. Regardless, NMFS included natural-origin spring chinook salmon from the Clackamas subbasin as part of the listed ESU and considers this spawning population a potentially important genetic resource for recovery.

Information ODFW (1998a) provided suggests that, at present, the only significant natural production of spring chinook salmon above Willamette Falls occurs in the McKenzie River basin. Nicholas (1995) also suggested that a self-sustaining population exists in the North Santiam River basin (BRT 1998), but ODFW contends that the thermal profile of water released from Detroit Dam significantly reduces the survival of any progeny from naturally spawning fish (64 FR 14308). The McKenzie River may now account for 50% of the production potential in the Willamette River basin, with 80% of that above Leaburg Dam. The number of natural-origin fish counted at Leaburg Dam increased from 786 in 1994 to 1,620 in 2000 (Table 8).

The Clackamas River currently accounts for about 20% of the production potential in the Willamette River basin, originating from one hatchery plus natural production areas that are primarily located above the North Fork Dam. The interim escapement goal for the area above North Fork Dam is 2,900 fish (ODFW 1998a). However, the system is so heavily influenced by hatchery production that it is difficult to distinguish spawners of natural stock from hatchery origin fish. Approximately 1,000 to 1,500 adults have been counted at the North Fork Dam in recent years.

More than 70% of the production capacity of the North Santiam system was blocked when Detroit Dam was built without passage facilities. The remaining downstream habitat is adversely affected by the temperature effects (i.e., warm water) of flow regulation. This system has also been substantially influenced by hatchery production, although the original genetic resource has been maintained as the Marion Forks Hatchery stock (ODFW 1998a). Despite these limitations, natural spawning continues in the lower river. The count of 194 redds in the area below Minto Dam (the lowest dam) during 1998 was marginally higher than during either of the preceding 2 years (Lindsay et al. 1998). The origin of these spawning adults has not been determined (although some coded-wire-tagged fish from Santiam River hatcheries have been recovered), nor has their reproductive success.

Mitigation hatcheries were built to offset the substantial habitat losses that resulted from dam construction. As a result, 85% to 95% of the production in the basin is now of hatchery origin. Although the hatchery programs have maintained broodlines that are relatively free of genetic influences from outside the basin, they may have homogenized within-basin stocks, reducing the population structure within the ESU. Prolonged artificial propagation of most of the production from this ESU may also have reduced the ability of Willamette River spring chinook salmon to reproduce successfully in the wild. Five of six existing hatchery stocks were included in the ESU, but none was listed or considered essential for recovery.

Table 8. Run size of spring chinook at the mouth of the Willamette River and counts at Willamette Falls and Leaburg Dam on the McKenzie River (Nicholas 1995; ODFW and WDFW 1998). The Leaburg counts show wild and hatchery combined and wild only since 1994.

Return Year	Estimated number entering Willamette River	Willamette Falls Count	Leaburg Dam Count	
			Combined	Wild Only
1985	57,100	34,533	825	
1986	62,500	39,155	2,061	
1987	82,900	54,832	3,455	
1988	103,900	70,451	6,753	
1989	102,000	69,180	3,976	
1990	106,300	71,273	7,115	
1991	95,200	52,516	4,359	
1992	68,000	42,004	3,816	
1993	63,900	31,966	3,617	
1994	47,200	26,102	1,526	825
1995	42,600	20,592	1,622	933
1996	34,600	21,605	1,445	1,105
1997	35,000	26,885	1,176	991
1998	45,100	34,461	1,874	1,415
1999	53,900	40,400	1,909	1,383
2000[1]	59,900	40,300	2,100	1,620

[1] preliminary

The spring run has been counted at Willamette Falls since 1946, but jacks were not differentiated from the total count until 1952. The geometric mean of the estimated run size from 1946 through 1950 was 43,300 fish, compared to an estimate for the most recent 5 years (1996 through 2000) of 32,700 (Table 22 in ODFW and WDFW 1999, and Table 8). Nicholas (1995) estimated only 3,900 natural spawners in 1994 for the ESU, approximately 1,300 of these naturally produced. The number of naturally spawning fish has increased gradually in recent years, but NMFS believes that many are first-generation hatchery fish.

For the UWR chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[4] ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for the aggregate UWR chinook salmon population in the McKenzie River, above Leaburg, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 (Table B-5 in McClure et al. 2000a). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 0.85 (Table B-6 in McClure et al. 2000a).

<u>Lower Columbia River Chinook Salmon</u>
The LCR chinook salmon ESU includes spring stocks as well as fall tule and bright components. The abundance of fall chinook greatly exceeds that of the spring component in the LCR chinook ESU. Spring-run chinook salmon on the lower Columbia River, like those from coastal stocks, enter freshwater in March and April, well in advance of spawning in August and September. Historically, the spring migration was synchronized with periods of high rainfall or snowmelt to provide access to upper reaches of most tributaries, where spring stocks would hold until spawning (Fulton 1968, Olsen et al. 1992, WDF et al. 1993). Fall run fish do not begin entry to the Columbia River until at least August and so are not affected by the actions being considered here.

The remaining spring-run chinook salmon stocks in the LCR chinook salmon ESU are found in the Sandy River, Oregon, and the Lewis, Cowlitz, and Kalama rivers, Washington. Spring chinook salmon in the Clackamas River are considered part of the UWR chinook salmon ESU. Despite the substantial influence of fish from hatcheries in the Upper Willamette River ESU in past years, naturally spawning spring chinook salmon in the Sandy River are included in the LCR chinook salmon ESU because they probably contain the remainder of the original genetic legacy for that system. Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998b). Hatchery-origin spring chinook salmon are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is relatively low, on the order of 10% to 20% in recent years. In 1999, the escapement dropped to 1,828 fish, in part because only unmarked naturally produced fish were passed over Marmot Dam (Schroeder et al. 1999).

On the Washington side, spring chinook salmon were native to the Cowlitz and Lewis rivers and there is anecdotal evidence that a distinct spring run existed in the Kalama River subbasin (WDF 1951). The Lewis River spring run was severely affected by dam construction. During the

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[4] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1998 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

period between the construction of Merwin Dam in 1932 and Yale Dam in the early 1950s, WDF attempted to maintain the run by collecting adults at Ariel/Merwin for hatchery propagation or (in years when returns were in excess of hatchery needs) release to the spawning grounds (WDF 1951). As native runs dwindled, Cowlitz spring-run chinook salmon were reintroduced in an effort to maintain them. In the Kalama River, escapements of less than 100 fish were present until the early 1960s when spring-run hatchery production was initiated with a number of stocks from outside the basin. Recent (1994 through 1998) average estimates for naturally spawning spring chinook salmon are 235, 224, and 372 fish in the Cowlitz, Kalama, and Lewis rivers, respectively. Some (perhaps a large) proportion of the natural spawners in each system is believed to be composed of hatchery strays (ODFW 1998b). Although, the Lewis and Kalama hatchery stocks have been mixed with out-of-basin stocks, they are included in the ESU. The Cowlitz River hatchery stock is largely free of introductions. Although it is considered essential for recovery, it is not listed because the state of Washington's hatchery and harvest practices are considered sufficiently protective of this stock to ensure that their future existence and value for recovery are not at risk (64 FR 14321). Spring chinook salmon returning to the Cowlitz, Kalama, and Lewis rivers have declined in recent years, but they still number several hundred to a few thousand in each system (Table9).

Table 9. Estimated Lower Columbia River spring chinook tributary returns, 1992-2000. (ODFW/WDFW 2000)

Year	Sandy R.	Cowlitz R.	Lewis R.	Kalama R.	Total Returns Excluding the Willamette System
1992	8,600	10,400	5,600	2,400	27,200
1993	6,400	9,500	6,600	3,000	25,500
1994	3,500	3,100	3,000	1,300	10,900
1995	2,500	2,200	3,700	700	9,100
1996	4,100	1,800	1,700	600	8,200
1997	5,200	1,900	2,200	600	9,900
1998	4,300	1,100	1,600	400	7,400
1999	3,300	1,600	1,900	600	7,400
2000		2,000	2,600	1,400	

Although the fall components of the LCR ESU are not affected by the proposed w/s/s season fisheries, their status is briefly summarized here as it is relevant to the overall status of the ESU. Apparently, three self-sustaining natural populations of tule chinook salmon that are not substantially influenced by hatchery strays occur in the lower Columbia River (Coweeman, East Fork Lewis, and Clackamas). Returns to the East Fork and Coweeman have been stable and near interim escapement goals in recent years. Recent 5- and 10-year average escapements to the East Fork Lewis River met the interim escapement goal of 300. Recent 5- and 10-year average escapements to the Coweeman River are 900 and 700, respectively, compared to an interim natural escapement goal of 1,000 (pers. comm., from G. Norman, WDFW to P. Dygert NMFS, February 22, 1999). Natural escapement on the Clackamas has averaged about 350 in recent years. There have been no releases of hatchery fall chinook salmon in the Clackamas since 1981, and there are apparently few hatchery strays. The population is considered depressed, but stable and self-sustaining (ODFW 1998b). There is some natural spawning of tule fall chinook salmon in the Wind and Little White Salmon rivers, tributaries above Bonneville Dam (the only component of the ESU that is affected by Tribal fisheries). Although there may be some natural production in these systems, the spawners are primarily hatchery-origin strays.

LCR bright fall chinook salmon escapement to the North Fork Lewis River exceeded the escapement goal of 5,700 by a substantial margin every year from the 1970s until 1978. However, runs have been declining and, probably combined with the effect of the 1996 and 1997 floods on habitat, the 1999 return was low (about 2,300). A return of 2,700 is forecast for 2000 (PFMC 2000), but preliminary information indicates that the escapement in 2000 was again well above the 5,700 fish escapement goal.

There are two smaller populations of LCR bright fall chinook salmon in the Sandy and East Fork Lewis rivers. Run sizes in the Sandy River have averaged about 1,000 and have been stable for the last 10 to 12 years. The fall chinook salmon hatchery program in the Sandy River was discontinued in 1977, with the intention of reducing the number of hatchery strays in the system. There is also a late spawning component in the East Fork Lewis River that is comparable in timing to the other bright stocks. The escapement of these fish is not as well documented, but it appears to be stable and largely unaffected by hatchery fish (ODFW 1998b).

All basins in the region are affected by habitat degradation to varying degrees. Major habitat problems are related primarily to blockages, forest practices, urbanization in the Portland and Vancouver areas, and agriculture in floodplains and low-gradient tributaries. Substantial chinook salmon spawning habitat has been blocked (or passage has been substantially impaired) in the Cowlitz (Mayfield Dam 1963, Rkm 84), Lewis (Merwin Dam 1931, Rkm 31), Clackamas (North Fork Dam 1958, Rkm 50), Hood (Powerdale Dam 1929, Rkm 7), and Sandy (Marmot Dam 1912, Rkm 48; Bull Run River dams in the early 1900s) rivers (WDF et al. 1993, Kostow 1995).

For the LCR chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[5] ranges from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS estimated the risk of absolute

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[5] Estimates of median population growth rate, risk of extinction, and likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns for most spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

extinction for nine spawning aggregations,[6] using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Sandy River late run and Big Creek to 1.00 for Mill Creek (Table B-5 in McClure et al. 2000a). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is ≥0.99 for all but one of the nine spawning aggregations (zero for the Sandy River late run; Table B-6 in McClure et al. 2000a).

4.3.2 Steelhead

Steelhead stocks in the Columbia Basin have traditionally been distinguished as summer or winter-run stocks based on state of sexual maturity and time of river entry. All native fish returning to the Upper Willamette have a late winter-run return timing. Steelhead returning to the LCR are primarily winter-run fish while those returning to the MCR are primarily summer-run fish. All steelhead returning to the UCR and SRB ESUs are considered summer-run steelhead.

Summer-run steelhead are divided further as A-run and B-run steelhead based on size and age differences and run timing. Hatchery and natural-origin stocks can be readily distinguished based on scale patterns or the adipose fin clipped that is applied to virtually all hatchery-origin steelhead in the Columbia Basin. ESU designations, based in part on genetic affinities, do not correspond with these traditional stock divisions. As indicated above, some of the ESUs are a mix of summer and winter-run fish. All B-run steelhead return to the Snake River, but the Snake has A-run steelhead too which are all part of the SRB ESU. Because of past practice, management data bases are aligned with these more traditional designations. Only in the last couple of years in response to recent listings have managers sought to assess harvest mortality by ESU or look at other methods that allow different or finer levels of stock resolutions. The transition in assessment techniques is underway, but is not yet complete. Initial efforts using Genetic Stock Identification (GSI) techniques have been promising, but will require at least another year or two of assessment and development for this particular application prior to implementation as a management alternative.

The TAC recently completed a review of information related to the biology and harvest of steelhead in the fall season fisheries with particular emphasis on alternative methods for measuring harvest related mortality. Based on this review, and assuming that there is an intention to manage specifically for the more sensitive components of the composite of wild steelhead in the basin, TAC recommended prior to the 1999 fall season fisheries that steelhead mortality be assessed using a simplified method that differentiates between hatchery and wild fish and then further distinguishes based on length between small and large fish using a 77.5 cm threshold. This would replace the date and length methods that were used previously to distinguish between A and B-run steelhead (TAC 1999).

[6] McClure et al. (2000b) have calculated population trend parameters for additional LCR chinook salmon stocks.

This revised method is intended to resolve long standing concerns and debate about the date and length methods that were used previously to differentiate between A and B-run steelhead both in terms of run size and catch accounting. The method is an improvement in that it requires fewer assumptions and relies on a physical property (i.e., fish length) that can be mapped directly back to the populations of greatest concern. As discussed below, B-run steelhead are at greatest risk because of their current depressed status. Upon review TAC confirmed the prior observation that the fish returning to the traditional B-run tributaries were predominately large fish (defined as greater than 77.5 cm). These larger fish are more vulnerable to the fall season fisheries because of their large size and because their timing is coincident with that of the upriver chinook that are being targeted. A management system that focuses on large fish therefore also properly focuses on the weakest component of the run. Small fish benefit from this management approach too as they are subject to lower harvest rates due to their smaller size and earlier timing.

Snake River Basin Steelhead

Snake River Basin steelhead, like most inland steelhead, are summer-run which enter freshwater nine or ten months prior to spawning. Snake River Basin steelhead enter fresh water from June to October and spawn in the following spring from March to May. The two components, A-run and B-run, are distinguished based on their size, the timing of their respective adult migrations, and ocean-age. A-run steelhead are thought to be predominately smaller l-ocean fish that return primarily between June and mid-August. B-run steelhead are generally larger 2-ocean fish, that do not begin returning in substantial numbers until after mid-August. Because of these timing differences, it is the A-run component of the SRB steelhead ESU that is most affected by the proposed winter, spring, and summer season fisheries.

NMFS reviewed the status of SRB steelhead in more detail in its recent biological opinion on the 1999 fall season fisheries (NMFS 1999b). Although both components are declining, the B-run component is most depressed and subject to the highest overall harvest rates, primarily in the fall season fisheries, where it was a focus of concern and one the primary management constrains. NMFS (1999b) concluded that A-run steelhead in the SRB were depressed, but still above critical threshold levels. Harvest rates on SRB steelhead in the proposed fisheries considered in this opinion are relatively low and primarily affect A-run fish. Snake River Basin steelhead are therefore not considered as a principal management constraint in the current context.

For the SR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[7] ranges from 0.91 to 0.70, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for the A- and B-runs, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not

[7] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.01 for A-run steelhead and 0.93 for B-run fish (Table B-5 in McClure et al. 2000a). At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 for both runs (Table B-6 in McClure et al. 2000a).

Upper Willamette River Steelhead

The Upper Willamette River steelhead ESU occupies the Willamette River and its tributaries upstream of Willamette Falls. This is a late-migrating winter group, entering fresh water primarily in March and April (Howell *et al*. 1985). Only the late run is included in the ESU; the largest remaining population is in the Santiam River system. The North Santiam River hatchery stock (ODFW stock 21) is part of this ESU; listing of this hatchery stock was determined to be not warranted.

Steelhead in the Upper Willamette River Basin are heavily influenced by hatchery practices and introductions of non-native stocks, and native fish into areas not originally the home of steelhead. Fishways built at Willamette Falls in 1885, modified and rebuilt several times, have facilitated the introduction of Skamania-stock summer steelhead and early-migrating winter steelhead of Big Creek stock. Non-native production of summer steelhead appears quite low, and the summer population is almost entirely maintained by artificial production (Howell *et al*. 1985). Some naturally-reproducing returns of Big Creek-stock winter steelhead occur in the basin (primarily early stock) (Table 10). In recent years, releases of winter steelhead are primarily of native stock from the Santiam River system.

No estimates of abundance prior to the 1960's are available for this ESU. Recent run size can be estimated from redd counts, dam counts, and counts at Willamette Falls (late stock) (Table 10). Recent total-basin run size estimates exhibit general declines for winter steelhead. The majority of winter steelhead populations in this basin may not be self-sustaining.

Much of the Willamette River Basin is urban or agricultural, and clearcut logging has been widespread in the Willamette River watershed. Water temperatures and streamflows reach critical levels in the basin, and substantial channel modification and bank erosion exists.

A major threat to this ESU results from artificial production practices. Introgression from non-local winter hatchery stocks may occur. Artificial selection of later run timing may also result from competition with substantial numbers of hatchery fish and from selective fishing pressures.

For the UWR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[8] ranges from 0.94 to 0.87, decreasing as the effectiveness of

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[8] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1997 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for four spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the South Santiam River to 0.74 for the Calapooia River (Table B-5 in McClure et al. 2000a). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from 0.74 for the Calapooia River to 1.00 for the Mollala River and South Santiam River spawning aggregations (Table B-6 in McClure et al. 2000a).

Upper Columbia River Steelhead

The return of UCR natural-origin steelhead to Priest Rapids dam has declined from a 4-year average of 2,900 beginning in 1986/87 to 900 at present although the escapement as indicated by counts at Priest Rapids Dam have been stable, ranging between 800-900, for the last six years. The escapement goal for natural-origin fish is 4,500. UCR hatchery steelhead are included in the ESU and are also listed as endangered. The hatchery component is relatively abundant and routinely exceeds hatchery supplementation program needs by a substantial margin. (Because of the relative abundance of hatchery fish, NMFS is currently considering delisting the hatchery component of the UCR ESU.) The naturally spawning population of UCR steelhead have been augmented for a number of years by stray hatchery fish that have spawned naturally. Replacement ratios for naturally spawning fish (natural-origin and hatchery strays) are quite low, on the order of 0.3. This very low return rate suggests either that the productivity of the system is very low and the hatchery strays are largely supporting the population, or that the natural-origin fish are returning at or just below the replacement rate and the hatchery strays are not contributing substantially to subsequent adult returns. Despite these uncertainties, NMFS has authorized several steelhead supplementation programs in the upper Columbia River Basin. Efforts are underway to diversify broodstocks used for supplementation in an effort to minimize the differences between hatchery and natural-origin fish and to minimize the concerns associated with supplementation. NMFS expects that the supplementation program will benefit the listed fish due to the early life history

Table 10. Escapement of winter steelhead over Willamette Falls and over North Fork Dam on the Clackamas River, 1971-98.

Year[1]	Willamette Falls count			North Fork Dam
	Total	Early Stock[2]	Late Stock[3]	
1971	26,647	8,152	18,495	4,352
1972	23,257	6,572	16,685	2,634
1973	17,900	6,389	11,511	1,899
1974	14,824	5,733	9,091	680
1975	6,130	3,096	3,034	1,509
1976	9,398	4,204	5,194	1,488
1977	13,604	5,327	8,277	1,525
1978	16,869	8,599	8,270	2,019
1979	8,726	2,861	5,865	1,517
1980	22,356	6,258	16,097	2,065
1981	16,666	7,662	9,004	2,700
1982	13,011	6,117	6,894	1,446
1983	9,298	4,596	4,702	1,099
1984	17,384	6,664	10,720	1,238
1985	20,592	4,549	16,043	1,225
1986	21,251	8,475	12,776	1,432
1987	16,765	8,543	8,222	1,318
1988	23,378	8,371	15,007	1,773
1989	9,572	4,211	5,361	1,251
1990	11,107	1,878	9,229	1,487
1991	4,943	2,221	2,722	837
1992	5,396	1,717	3,679	2,107
1993	3,568	843	2,725	1,352
1994	5,300	1,025	4,275	1,247
1995	4,693	1,991	2,702	1,146
1996	1,801	479	1,322	325
1997	4,544	619	3,925	530
1998	3,678	757	2,921	504

[1] Represents year in which passage is completed. Passage began during the previous year. Total estimates of passage were not obtained prior to 1971 due to problems of access to the old fishway during higher flow periods.

[2] November 1 through February 15. These are mainly introduced Big Creek stock.

[3] February 16 through May 15. These are mainly indigenous Willamette stock.

survival advantage expected from the hatchery action. However, there are also substantive concerns about the long term effect on the fitness of natural-origin populations resulting from continuous long term infusion of hatchery-influenced spawners (Busby et al. 1996). In summary, the hatchery component of the UCR listed steelhead is relatively abundant with a stable population, while the natural component is depressed. It is hoped that supplementation efforts can be used to prevent further declines in abundance until the necessary improvements in system productivity take effect.

For the UCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[9] ranges from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for the aggregate UCR steelhead population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years is 0.25 (Table B-5 in McClure et al. 2000a). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 (Table B-6 in McClure et al. 2000a).

Because of data limitations, the QAR steelhead assessments in Cooney (2000) were limited to two aggregate spawning groups—the Wenatchee/Entiat composite and the above-Wells populations. Wild production of steelhead above Wells Dam was assumed to be limited to the Methow system. Assuming a relative effectiveness of hatchery spawners of 1.0, the risk of absolute extinction within 100 years for UCR steelhead is 100%. The QAR also assumed hatchery effectiveness values of 0.25 and 0.75. A hatchery effectiveness of 0.25 resulted in projected risks of extinction of 35% for the Wenatchee/Entiat and 28% for the Methow populations. At a hatchery effectiveness of 0.75, risks of 100% were projected for both populations.

<u>Middle Columbia River Steelhead</u>

The Middle Columbia steelhead ESU occupies the Columbia River Basin from Mosier Creek, OR, upstream to the Yakima River, WA, inclusive (61 FR 41541; August 9, 1996). Steelhead from the Snake River Basin (described elsewhere) are excluded. This ESU includes the only populations of inland winter steelhead in the United States, in the Klickitat River and Fifteenmile Creek (Busby *et al*. 1996). Two hatchery populations are included in this ESU, the Deschutes River stock (ODFW stock 66) and the Umatilla River stock (ODFW stock number 91); listing for neither of these stocks was considered warranted.

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[9] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period beginning in 1980 and including 1996 adult returns. Population trends are projected under the assumption that all conditions will stay the same into the future.

Life history information for steelhead of this ESU indicates that most MCR steelhead smolt at 2 years and spend 1 to 2 years in salt water (i.e., 1-ocean and 2-ocean fish, respectively) prior to re-entering fresh water, where they may remain up to a year prior to spawning (Howell et al., 1985). Within this ESU, the Klickitat River is unusual in that it produces both summer and winter steelhead, and the summer steelhead are dominated by 2-ocean steelhead, whereas most other rivers in this region produce about equal numbers of both 1-and 2-ocean steelhead.

Within the ESU, the Yakima, Umatilla and Deschutes River basins have shown an overall upward trend, although all tributary counts in the Deschutes River are downward and the Yakima River is recovering from extremely low abundance in the early 1980s. The John Day River probably represents the largest native, natural spawning stock in the ESU, and the combined spawner surveys for the John Day River have been declining at a rate of about 15 percent per year since 1985. However, estimates based on dam counts show an overall increase in steelhead abundance, with a relatively stable naturally-produced component. The NMFS, in listing this ESU as threatened, cited low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline for naturally-producing stocks within the ESU.

Hatchery fish are widespread and stray to spawn naturally throughout the region. Recent estimates of the proportion of natural spawners with hatchery origin range from low (Yakima River, Walla Walla River, John Day River) to moderate (Umatilla River, Deschutes River). Most hatchery production in this ESU is derived primarily from within-basin stocks. One recent area of concern is the increase in the number of Snake River hatchery (and possibly wild) steelhead that stray and spawn naturally within the Deschutes River Basin. Studies have been proposed to evaluate, hatchery programs within the Snake River Basin that have shown high rates of straying into the Deschutes River, and to make changes to minimize straying to rivers with in the Middle Columbia River ESU.

The ESU is in the intermontane region and includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of rainfall annually (Jackson 1993). Vegetation is of the shrub-steppe province, reflecting the dry climate and harsh temperature extremes. Because of this habitat, occupied by the ESU, factors contributing to the decline include agricultural practices, especially grazing, and water diversions/withdrawals. In addition, hydropower development has impacted the ESU through loss of habitat above hydro projects, and mortalities associated with migration through the Columbia River hydro system.

For the MCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[10] ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a

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[10] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for four of the spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Umatilla River and Deschutes River summer runs (Table B-5 in McClure et al. 2000a). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years ranges from zero for the Yakima River summer run to 1.00 for the Deschutes River summer run (Table B-6 in McClure et al.2000a).

Lower Columbia River Steelhead

The Lower Columbia River ESU includes naturally-produced steelhead returning to Columbia River tributaries on the Washington side between the Cowlitz and Wind rivers in Washington and on the Oregon side between the Willamette and Hood rivers, inclusive. In the Willamette River, the upstream boundary of this ESU is at Willamette Falls. This ESU includes both winter and summer steelhead. Two hatchery populations are included in this ESU, the Cowlitz Trout Hatchery winter-run stock and the Clackamas River stock (ODFW stock 122); listing of neither of these hatchery populations was considered warranted.

Available historical and recent Lower Columbia River steelhead abundance information is summarized in Busby *et al*. (1996). No estimates of historical (pre-1960s) abundance specific to this ESU are available. Because of their limited distribution in upper tributaries and the urbanization surrounding the lower tributaries (e.g., the lower Willamette, Clackamas, and Sandy Rivers run through Portland or its suburbs), summer steelhead appear to be at more risk from habitat degradation than are winter steelhead. The lower Willamette, Clackamas, and Sandy steelhead trends are stable or slightly increasing, but this is based on angler surveys for a limited time period, and may not reflect trends in underlying population abundance. Total annual run size data are only available for the Clackamas River (1,300 winter steelhead, 70% hatchery; 3,500 wild summer steelhead).

For the LCR steelhead ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period[11] ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin (Tables B-2a and B-2b in McClure et al. 2000a). NMFS has also estimated the risk of absolute extinction for seven of the spawning aggregations, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e., hatchery effectiveness = 0), the risk of absolute extinction within 100 years ranges from zero for the Kalama River summer run and the Clackamas River and Kalama River winter runs to 1.00 for the Clackamas River summer run and the Toutle River winter run

[11] Estimates of median population growth rate, risk of extinction, and the likelihood of meeting recovery goals are based on population trends observed during a base period that varies between spawning aggregations. Population trends are projected under the assumption that all conditions will stay the same into the future.

(Table B-5 in McClure et al. 2000a). Assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years rises to 1.00 for all but one population (the risk of extinction is 0.86 for the Green River winter run; Table B-6 in McClure et al. 2000a).

4.3.3 Sockeye Salmon

Snake River Sockeye Salmon
Historically, Snake River sockeye salmon were produced in the Salmon River subbasin in Alturas, Pettit, Redfish, and Stanley lakes and in the South Fork Salmon River subbasin in Warm Lake. Sockeye salmon may have been present in one or two other Stanley basin lakes (Bjornn et al. 1968). Elsewhere in the Snake River basin, sockeye salmon were produced in Big Payette Lake on the North Fork Payette River and in Wallowa Lake on the Wallowa River (Evermann 1895, Toner 1960, Bjornn et al. 1968, Fulton 1970).

The largest single sockeye salmon spawning area was in the headwaters of the Payette River, where 75,000 were taken one year by a single fishing operation in Big Payette Lake. However, access to production areas in the Payette basin was eliminated by construction of Black Canyon Dam in 1924. During the 1980s, returns to headwaters of the Grand Ronde River in Oregon (Wallowa Lake) were estimated to have been at least 24,000 and 30,000 sockeye salmon (Cramer 1990), but access to the Grand Ronde was eliminated by construction of a dam on the outlet to Wallowa Lake in 1929. Access to spawning areas in the upper Snake River basin was eliminated in 1967 when fish were no longer trapped and transported around the Hells Canyon Dam complex. All of these dams were constructed without fish passage facilities.

There are no reliable estimates of the number of sockeye salmon spawning in Redfish Lake at the turn of the century. However, beginning in 1910, access to all lakes in the Stanley basin was seriously reduced by the construction of Sunbeam Dam, 20 miles downstream from Redfish Lake Creek on the mainstem Salmon River. The original adult fishway, constructed of wood, was ineffective at passing fish over the dam (Kendall 1912). It was replaced with a concrete structure in 1920, but sockeye salmon access was impeded until the dam was partially removed in 1934. Even after fish passage was restored at Sunbeam Dam, sockeye salmon were unable to use spawning areas in two of the lakes in the Stanley basin. Welsh (1991) reported fish eradication projects in Pettit Lake (treated with toxaphene in 1960) and Stanley Lake (treated with Fish-Tox, a mixture of rotenone and toxaphene, in 1954). Agricultural water diversions cut off access to most of the lakes. Bjornn et al. (1968) stated that, during the 1950s and 1960s, Redfish Lake was probably the only lake in Idaho that was still used by sockeye salmon each year for spawning and rearing, and, at the time of listing under ESA, sockeye salmon were produced naturally only in Redfish Lake.

Escapement to the Snake River has declined dramatically in the last several decades. Adult counts at Ice Harbor Dam declined from 3,170 in 1965 to zero in 1990 (ODFW and WDFW 1998). The Idaho Department of Fish and Game counted adults at a weir in Redfish Lake Creek during 1954 through 1966; adult counts dropped from 4,361 in 1955 to fewer than 500 after 1957 (Bjornn et al. 1968). A total of 16 wild sockeye salmon returned to Redfish Lake between 1991 and 1999 (Table 11). During 1999, seven hatchery-produced, age-3 adults returned to the Sawtooth Hatchery. Three of these adults were released to spawn naturally, and four were taken into the IDFG captive broodstock program. In 2000, 257 hatchery-produced, age-4 sockeye salmon returned to the Stanley basin (weirs at the Sawtooth Hatchery and Redfish Lake Creek). Adults numbering 243 were handled and redistributed to Redfish (120), Alturas (52), and Pettit (28) lakes, with the remaining 43 adults incorporated into the IDFG captive broodstock program at Eagle Hatchery.

Table 11. Returns of Snake River sockeye salmon to Lower Granite Dam and to Redfish Lake, as determined by dam count, trapping at Redfish Lake creek weir, and spawning ground surveys.

Year	Lower Granite Dam count	Adults arriving at Redfish Lake or the Sawtooth Hatchery Weir
1985	35	12
1986	15	29
1987	29	16
1988	23	4
1989	2	1
1990	0	0
1991	8	4
1992	1	1
1993	12	8
1994	2	1
1995	4	0
1996	0	1
1997	2	1
1998	3	0
1999	14	7
2000	282	*257*

Low numbers of adult Snake River sockeye salmon preclude a CRI- or QAR-type quantitative analysis of the status of this ESU. However, because only16 wild and 264 hatchery-produced adult sockeye returned to the Stanley basin between 1990 and 2000, NMFS considers the status of this ESU to be dire under any criteria.

5.0 ENVIRONMENTAL BASELINE

The purpose of this section is to identify "the past and present effects of all Federal, State, or private activities in the action area, the anticipated effects of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the effect of State or private actions which are contemporaneous with the consultation in process" (50 CFR § 402.02, definition of *effects of the action*). These factors affect the species' environment or critical habitat in the action area. The factors are described in relation to the action area biological requirements of the species.

In addition to harvest activities, the activities having the greatest effect on the environmental baseline generally fall into four categories: hydropower system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; adverse genetic and competitive impacts from artificial production programs; and fluctuations in natural conditions.

5.1 Description of Action Area

The action area relative to adult Columbia basin salmonids is the part of their habitat that is affected by the proposed treaty-Indian (Zone 6) and non-Indian (Zones 1-5) fisheries in the mainstem Columbia River, as described in the permit application (Tweit and Norman 20000 and in the biological assessment (Speaks 2000).

5.2 Biological Requirements in Action Area

Ten of the 12 listed salmonid ESUs are potentially affected by the proposed fisheries considered in this opinion (Table 2). Biological requirements during the adult life history stage are obtained through access to essential features of critical habitat. Essential features include adequate 1) substrate (especially spawning gravel), 2) water quality, 3) water quantity, 4) water temperature, 5) water velocity, 6) cover/shelter, 7) food, 8) riparian vegetation, 9) space, and 10) migration conditions (58 FR 68546 for Snake River salmon and 65 FR 773 for all other Columbia River basin salmonids). These features are nearly identical to those characterized as Essential Fish Habitat (EFH) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (PFMC 1999).

5.2.1 Essential Features of Critical Habitat in Action Area

The sections below describe essential features of critical habitat for each of the relevant habitat types: 1) adult migration corridors, and 2) spawning areas in the action area discussed in the following sections.

<u>Adult Migration Corridors</u>

Essential features of critical habitat for adult migration corridors include all the essential features of critical habitat for juvenile migration corridors (above), except for adequate food.

Spawning Areas

Essential features of critical habitat for spawning areas include all the essential features of critical habitat for juvenile rearing areas (above), with the addition of adequate substrate and the exception of adequate food.

5.2.2 Adequacy of Habitat Conditions in Critical Habitat

Regulations implementing Section 7(a)(2) of the ESA define "destruction or adverse modification" as "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species." Adverse effects on a constituent element of critical habitat generally do not result in a determination of "adverse modification" unless that loss, when added to the environmental baseline, is likely to result in an appreciable diminishment of the value of the critical habitat for both the survival and the recovery of the listed species (50 CFR Section 402.02).

Quantitatively defining a level of adequacy through specific, measurable standards is difficult for many of these biological requirements. In many cases, the absolute relationship between the critical element and species survival is not clearly understood, thus limiting development of specific, measurable standards. In contrast, some parameters are generally well known in the fisheries literature (e.g., thermal tolerances). Others are developed in this biological opinion (e.g., a temperature objective at Lower Granite Dam). For the remaining action-area biological requirements, the effects of any adverse impacts on essential features of critical habitat are considered in more qualitative terms.

5.3 Factors Affecting Species' Environment in Action Area

5.3.1 Hydrosystem Effects

Columbia River basin anadromous salmonids, especially those above Bonneville Dam, have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause fluctuation in flow levels and river elevations, affecting fish movement through reservoirs and riparian ecology and stranding fish in shallow areas. The eight dams in the migration corridor of the Snake and Columbia rivers alter smolt and adult migrations. Smolts experience a high level of mortality passing through the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts' journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor are now far more dependent on volume runoff than before development of the mainstem reservoirs.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between the Action Agencies (Corps of Engineers, Bureau and Bonneville Power Administration) and the services (NMFS and USFWS). The changes have improved survival for the listed fish migrating through the Snake and Columbia rivers. Increased spill at all FCRPS dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia rivers provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also been improved by the addition of new barges and modification of existing barges.

In addition to spill, flow, and transportation improvements, the Corps implemented numerous other improvements to project operations and maintenance at all Columbia and Snake River dams. These improvements, such as operating turbines at peak efficiency, new extended-length screens at McNary, Little Goose, and Lower Granite dams, and extended operation of bypass screens, are discussed in greater detail in the 2000 FCRPS Biological Opinion (NMFS 2000a).

It is possible to quantify the survival benefits accruing from these many actions for each of the listed ESUs. For SR spring/summer chinook smolts migrating inriver, the estimated survival through the hydrosystem is now between 40% and 60%, compared with an estimated survival rate during the 1970s of 5% to 40%. SR steelhead have probably received a similar benefit because their life history and run timing are similar to that of spring/summer chinook (NMFS 2000b). It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all listed Columbia basin salmonids and that the benefits will be greater the farther upriver the ESU. However, further improvements are necessary because the Federal hydrosystem continues to cause a significant level of mortality for some ESUs. NMFS has just recently completed a reinitiated consultation on the FCRPS (NMFS 2000a) and the related all-H paper (Federal Caucus 2000). These provide direction for the future configuration and operation of the FCRPS and a blue print for actions required in other sectors considered necessary for the survival and recovery of listed species.

Several non-Federal projects licensed by the Federal Energy Regulating Commission (FERC) also affect the 12 ESUs on the mainstem Columbia and Snake rivers. Many of the ESUs are also affected by FERC projects on smaller tributaries or other water development projects. Some of the effects to particular ESUs are discussed in more detail in section 4.

5.3.2 Habitat Effects

The quality and quantity of freshwater habitat in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydrosystem development, mining, and urbanization have radically changed the historical habitat conditions of the basin. With the exception of fall chinook, which generally spawn and rear in the mainstem, salmon and steelhead spawning and rearing habitat is found in tributaries to the Columbia and Snake rivers. Anadromous fish typically spend from a few months to 3 years rearing in freshwater tributaries. Depending on the species, they spend from a few days to 1 or 2 years in the Columbia River estuary before migrating out to the ocean and another 1 to 4 years in the ocean before returning as adults to spawn in their natal streams. Thirty-two subbasins provide spawning and rearing habitat.

Water quality in streams throughout the Columbia River basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally approved, state and Tribal water quality standards and are now listed as water quality limited under Section 303(d) of the CWA. Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Most of the water bodies in Oregon, Washington, and Idaho that are on the 303(d) list do not meet water quality standards for temperature. Temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that result in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres of land in the basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers.

On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density, which can affect timing and duration of runoff. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have become developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Many tributaries have been significantly depleted by water diversions. In 1993, fish and wildlife agency, Tribal, and conservation group experts estimated that 80% of 153 Oregon tributaries had low-flow problems (two-thirds caused at least in part by irrigation withdrawals) (Oregon Water Resources Department 1993). The NWPPC showed similar problems in many Idaho, Oregon, and Washington tributaries (NWPPC 1992).

Blockages that stop the downstream and upstream movement of fish exist at many agricultural, hydrosystem, municipal/industrial, and flood control dams and barriers. Highway culverts that are not designed for fish passage also block upstream migration. Migrating fish are diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. While many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land use changes. Federal lands, which compose 50% of the basin, are generally forested and influence upstream portions of the watersheds. While there is substantial habitat degradation across all ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993, Frissell 1993, Henjum et al. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence et al. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

Mainstem habitats of the Columbia, Snake, and Willamette rivers have been affected by impoundments that have inundated large amounts of spawning and rearing habitat. Historically, fall chinook salmon spawned in the mainstem near The Dalles, Oregon, upstream to the Pend Oreille River in Washington and the Kootenai River in Idaho, in the Snake River downstream of Shoshone Falls, and upstream from the mouth of the Snake River to Grand Coulee Dam. Current mainstem production areas for fall chinook are mostly confined to the Hanford Reach of the mid-Columbia River and to the Hells Canyon Reach of the Snake River, with minor spawning populations elsewhere in the mid-Columbia, below the lower Snake River dams, and below Bonneville Dam. Hanford Reach is the only known mainstem spawning area for steelhead. Chum salmon habitat in the lower Columbia may also have been inundated by Bonneville Reservoir. Mainstem habitat in the Columbia, Snake, and Willamette rivers has been reduced, for the most part, to a single channel, floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

The Columbia River estuary has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars, and shallow areas. The mouth of the Columbia River was about 4 miles wide. Winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened and maintained, jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels, marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to 2 miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. Sand deposition at river mouths has extended the Oregon coastline approximately 4 miles seaward and the Washington coastline approximately 2 miles seaward (Thomas 1981).

More than 50% of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (Lower Columbia River Estuary Program 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced, and the amount of water discharged during winter has increased.

Studies begun in 1997 by the Oregon Cooperative Fish and Wildlife Research Unit, the USGS, and CRITFC have shown that fish-eating birds that nest on islands in the Columbia River estuary (Caspian terns, double-crested cormorants, and glaucous-winged gulls) are significant avian predators of juvenile salmonids. Researchers estimated that the tern population on Rice Island (16,000 birds in 1997) consumed 6 to 25 million outmigrating smolts during 1997 (Roby et al. 1998) and 7 to 15 million during 1998 (Collis et al. 1999). The observed levels of predation prompted the regional fish and wildlife managers to investigate the feasibility of management actions to reduce the impacts. Early management actions appear to have reduced predation rates; researchers estimate that terns consumed 7.3 million smolts during 1999 (Columbia Basin Bird Research 2000). Because Rice Island is a dredged material disposal site in the Columbia River estuary, created by the Corps under its Columbia River Channel Operation and Maintenance Program, the effects of tern predation on the survival and recovery of listed salmonids are considered in a separate consultation on that program. This factor is considered part of the environmental baseline on effects of the FCRPS.

The All-H Paper outlines a broad range of current habitat programs. Because most of the basin’s anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Current management is governed by an ecosystem-based aquatic habitat and riparian-area management strategy known as PACFISH, and associated biological opinions. This interim strategy covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation.

The All-H Paper also outlines a large number of non-Federal habitat programs. However, because non-Federal habitat is managed predominantly for private rather than public purposes, expectations for non-Federal habitat are harder to assess. Degradation of habitat for listed fish from activities on non-Federal lands is likely to continue to some degree over the next 10 years, although at a reduced rate due to state, Tribal, and local recovery plans.

5.3.3 Hatchery Effects

For more than 100 years, hatcheries in the Pacific Northwest have been used to replace natural production lost as a result of the FCRPS and other development, not to protect and rebuild natural populations. As a result, most salmon populations in this region are primarily hatchery fish. In 1987, for example, 95% of the coho, 70% of the spring chinook, 80% of the summer chinook, 50% of the fall chinook, and 70% of the steelhead returning to the Columbia Basin originated in hatcheries (Columbia Basin Fish and Wildlife Authority 1990).

While hatcheries certainly have contributed greatly to the overall numbers of salmon, only recently has the effect of hatcheries on native wild populations been demonstrated. In many cases, these effects have been substantial. For example, production of hatchery fish, among other factors, has contributed to the 90% reduction in wild coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995). Hatcheries have traditionally focused on providing fish for harvest, with less attention given to identifying and resolving factors causing declines of native runs.

NMFS has identified four primary categories of risk that hatcheries can pose on wild-run salmon and steelhead: 1) ecological effects, 2) genetic effects, 3) overharvest effects, and 4) masking effects (NMFS 2000c). Ecologically, hatchery fish can increase predation on, displace, and/or compete with wild fish. These effects are likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods, during which they may prey on or compete with wild fish. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release diseases into streams via water effluents.

Genetically, hatchery fish can affect the genetic variability of native fish via interbreeding, either intentionally or accidentally. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to and productive within the unique local habitats where the original native stock evolved.

In many areas, hatchery fish provide increased fishery opportunities. When wild fish mix with hatchery stock, fishing pressure can lead to overharvest of smaller or weaker wild stocks. Further, when migrating adult hatchery and wild fish mix on the spawning grounds, the health of the wild runs and the condition of the habitat’s ability to support runs can be overestimated, because the hatchery fish mask surveyors’ ability to discern actual wild run conditions.

NMFS determined that there is an need for immediate hatchery reform and conservation actions (Federal Caucus 2000). Federal agencies will work with the NWPPC to accelerate funding and implementation of the reform measures from the hatchery biological opinions and related actions that should proceed over the next 1 to 3 years. Such reforms will be pursued in the context of the Hatchery and Genetic Management Plans (HGMP). The HGMP is a tool for defining goals and objectives of a particular hatchery, and its relationship to prioritized basin objectives, including harvest opportunities and wild stock performance. Specifically, each HGMP should ensure that genetic broodstock selected is appropriate, that it minimizes the potential for adverse ecological effects on wild populations, and that it is integrated into basinwide strategies to meet objectives of all Hs.

5.4 Natural Conditions

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. For example, large-scale climatic regimes, such as El Niño, affect changes in ocean productivity. Much of the Pacific Coast was subject to a series of very dry years during the first part of the 1990s. In more recent years, severe flooding has adversely affected some stocks. For example, the low return of Lewis River bright fall chinook salmon in 1999 is attributed to flood events during 1995 and 1996.

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target UWR spring chinook salmon in the fish ladder at Willamette Falls.

A key factor substantially affecting many West Coast stocks has been the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time series of survival rate information for UWR spring chinook, Lewis River fall chinook, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999a).

Recent evidence suggests that marine survival of salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Cramer et al. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation (PDO). Ocean conditions that affect the productivity of Northwest salmonid populations appear to have been in a low phase of the cycle for some time and to have been an important contributor to the decline of many stocks. The survival and recovery of these species will depend on their ability to persist through periods of low natural survival.

5.5 Snake River Basin Fisheries Effects

5.5.1. Idaho Sport Fishing Impacts on Listed Anadromous Fish

The State of Idaho has elected to address ESA impacts of Idaho recreational fisheries through Section 10 Incidental Take Permits. A permit authorizing take of listed chinook and sockeye salmon in Idaho recreational fisheries was issued in 1993, covering a period of 5 years (NMFS 1993). That permit was due to expire in mid-1998, but was extended through December 31, 1998 to allow detailed consideration of a renewed permit. An additional permit was issued to cover the 1999 fisheries. NMFS issued a multi-year permit to Idaho in order to address continued incidental take of listed salmonids for state-operated recreational fisheries during 2000-2003.

The application covers recreational fisheries conducted in Idaho rivers waters where some listed anadromous fish may occur, implemented under three categories--General Fishing Regulations, Anadromous Salmon Fishing Regulations, and Steelhead Fishing Regulations. Specific fisheries considered include:
* fisheries targeting non-listed, hatchery-produced adult, anadromous steelhead
* fisheries for resident trout and other game fish species that incidentally take juvenile steelhead
* fisheries targeting adult, non-listed hatchery-produced chinook
* fisheries targeting non-listed resident fish trout and kokanee in the Stanley Basin lakes, including Redfish Lake

Redfish Lake is open for kokanee (non-anadromous sockeye salmon) fishing from January 1 through August 7, with the bulk of the effort starting in May. The other Stanley Basin lakes into which listed sockeye have been released--Pettit Lake and Alturas Lake--are open to kokanee fishing year-round, with low fishing pressure. A recreational kokanee fishery would be expected to take up to 34 unmarked, residual, listed adult and juvenile sockeye in Redfish Lake, and up to 30 marked listed juvenile sockeye in each of Redfish, Pettit, and Alturas Lakes. These sockeye would be taken incidental to the harvest of an estimated 1/3 to 1/2 of the kokanee population of the lakes. Between 1995-1998, a total incidental harvest of 59 or fewer listed, unmarked sockeye is estimated to have occurred.

Although the lakes are open to fishing year-around, a recreational trout fishery in lakes of the Stanley Basin is dependent upon the stocking of these lakes with catchable trout, an action which occurs only in Alturas and Pettit Lakes. Release of trout for put-and-take fishing in Redfish Lake has not yet been authorized. If such stocking does occur, and a fishery is implemented, take of listed hatchery-origin Snake River sockeye salmon may occur in Redfish, Pettit, and Alturas Lakes. IDFG estimates that up to one sockeye may be hooked in each lake in which a resident fishery occurs, with live release of sockeye required (Moore 1999).

The spring steelhead season is open from January 1 until March 31 in the mainstem of the Salmon River and until April 30 in other waters that contain hatchery steelhead. The Little Salmon River is open to harvest during the entire steelhead season. Only marked, hatchery-produced steelhead may be retained by fishermen and all unmarked fish hooked unintentionally while fishing for hatchery fish must be released, alive and unharmed, back to the water. Additionally, areas around fish weirs and tributaries where wild steelhead spawn are closed to all fishing during the time of year that listed fish could be expected to be present. The impact to wild, listed steelhead is estimated to be less than 2.5 percent of the population, or less than 250 of roughly 10,000 wild steelhead returning to the Snake River Basin ESU. The wild steelhead taken in these fisheries include both A-run and B-run steelhead.

Most resident trout fishing seasons open the last Saturday in May, after wild steelhead smolts have emigrated and adult steelhead have moved into sanctuary areas and nearly all listed steelhead have spawned, and extends through November 30. Certain river sections are open all year, while other river and stream sections remain closed for part or all of the general season. Hooking of listed adult steelhead incidental to fishing for resident species is unlikely to occur.

State regulations use a suite of restrictions to protect juvenile steelhead, depending on the local conditions, including prohibiting retention of unmarked (wild) juvenile steelhead. The juvenile steelhead are further protected by fishing regulations that require release of fish under a minimum size (designed to protect smolts), require all fish to be released, adjust seasons to avoid times and places where steelhead are vulnerable to harvest, and/or restrict fishing methods which might injure smolts.

Recreational fisheries targeting hatchery-produced spring and summer chinook open dependent upon sufficient return size. Chinook seasons, when open, start in mid-May, closing on or before August 4 on the Little Salmon, South Fork Salmon, and Clearwater Rivers (recently, chinook fisheries have closed on or before July 21 on the Little Salmon River; IDFG prefers to establish a uniform date of August 4 for the closure of all chinook fisheries). Chinook salmon recreational fisheries are most likely to occur in the Clearwater and Little Salmon Rivers. A recreational fishery took place on the South Fork Salmon River in 1997, based on a relatively large return of marked, unlisted hatchery fish. If fishing seasons are opened for adult chinook salmon, retention will only be allowed of marked, hatchery-produced fish that are surplus to spawning escapement needs. Only waters where hatchery fish are expected to be available will be open to fishing. Limited seasons will be opened only after dam counts indicate surplus fish are present, and only after consultation with NMFS. Juvenile chinook are protected by the same state fishing regulations that protect juvenile steelhead. Recreational angling impacts to listed chinook salmon in the Snake River ESU are very small. There are no listed Snake River fall chinook salmon present in areas open to fishing during the time period of this consultation.

5.5.2. Treaty Indian chinook fisheries

The information necessary to assess impacts of additional tribal fisheries targeted on spring/summer chinook salmon in the Snake River Basin is not yet available. The potential impact of the Snake River Basin fisheries will, therefore, be considered in a subsequent biological opinion. Because of the generally poor outlook for the return of natural-origin fish to the Snake Basin, additional fishing opportunity in the Snake Basin is expected to be extremely limited and with few additional impacts to listed spring/summer chinook salmon. As in recent years, the only fisheries anticipated are in terminal areas where unlisted hatchery fish are targeted. Because of the higher anticipate return of hatchery-origin fish this year, there is likely to be substantially more opportunity to catch fish in these terminal area, hatchery directed fisheries.

5.5.3. Recreational tributary fisheries in Washington and Oregon

Concern for the status of wild steelhead in the 1980s stimulated the states of Oregon and Washington (and Idaho) to mark all hatchery produced steelhead and initiate the first marked-fish-only regulations in the Columbia Basin. Since 1984, all steelhead smolts released from hatchery programs have been marked with an adipose fin clip and state fishing regulations require that unmarked fish must be released unharmed. Fishing seasons are only open in rivers where hatchery fish are expected to be present and many rivers are closed to fishing as sanctuaries for listed fish. Harvest rates on hatchery runs exceed 50 percent when hatchery fish concentrate downstream from hatcheries, but the overall harvest rate is usually in the range of 30 to 40 percent of the run as counted at Ice Harbor dam. Nearly all Snake River fishing takes place in the cooler months and hooking mortality is estimated to be 5 percent of released fish. If 50% of the listed population is subjected to a 5 percent hooking mortality, the population impact is 2.5 percent. However, the 2.5% harvest rate generally overstates the likely impact to most stocks returning to natural-production areas because they are not subject to the concentrated fisheries that are targeting hatchery fish in particular terminal areas.

Hatchery steelhead smolt releases in the Upper Columbia River have been adipose-clip marked since the mid-1980s, and selective fishery regulations have been in place. The entire Upper Columbia ESU was closed to all steelhead fishing when the hatchery population was included in the listing decision in 1997. Most of the Upper Columbia is lightly fished, compared to the more popular reaches in the Snake River basin and fisheries are concentrated in dam tail races and a few tributary rivers. Harvest rates were in the range of 40 percent of the run as counted at Priest Rapids Dam; overall population impact on wild fish is estimated to have been less than 2.5 percent by applying the 5% hooking mortality rate to 40 percent of the population.

Marking of hatchery releases and marked-only retention of wild fish did not become universal in the Lower Columbia ESU until 1990, and harvest rates in excess of 60 percent were reported for both natural and hatchery produced fish. Since 1992 only marked fish may be retained, seasons have been shortened and some rivers have been closed as sanctuaries for wild fish. NMFS estimates fishing impacts on wild, listed fish to be limited to 5 percent hooking mortality applied to 60 percent of the population or approximately 3 percent as a population impact.

The conservation issues surrounding the impacts of state-operated recreational steelhead fisheries in the tributaries are being addressed in a separate process involving the issuance of federal regulations under section 4(d) of the ESA and federal approval of state recreational fishery management plans. Final 4(d) rules for the listed steelhead ESUs were published on July 10. 2000. The 4(d) rules and associated take prohibitions are in effect as of September 8, 2000.

5.6 Ocean Fisheries Effects

While impacts from ocean fisheries on listed sockeye, steelhead, and chinook salmon are not within the action area of the proposed action, those impacts are summarized here to provide a more complete accounting of harvest impacts on these species.

Impacts from ocean fisheries on listed spring/summer chinook and sockeye salmon have been considered in recent biological opinions. NMFS (1996b) concluded that it is highly unlikely that any Snake River sockeye salmon are taken in salmon fisheries off the west coast and that, although Snake River spring/summer chinook may on occasion be taken, the overall ocean exploitation rate is likely less than 1%. NMFS (1998c) also reviewed the potential impacts to steelhead for ocean salmon fisheries. Since steelhead are only rarely caught in these fisheries, it is unlikely that any of the listed or proposed steelhead ESUs are significantly impacted.

This consultation regarding Columbia River Basin fisheries, in combination with the fisheries considered as part of the environmental baseline, therefore provides a review of the vast majority of fishery-related impacts that are likely to affect returning SR spring/summer chinook, UCR spring chinook and SR sockeye salmon. Although there are some impacts to steelhead in the winter/spring/summer season fisheries considered in this opinion, the majority of impacts occur during fall season fisheries, which will be the subject of future consultation.

5.7 Expected Future Performance

Most ESUs in the Columbia Basin will experience improved survivals as a result of improvements in FCRPS operations and configuration, habitat improvements on Federal lands, improvements in hatchery practices, and improvements in harvest measures. Notwithstanding these improvements, however, is the fact that environmental conditions are still generally quite poor with respect to salmonid survival in a number of their life phases. In fact, for many stocks, survivals must improve by an order of magnitude in order for the ESUs to survive and recover. The long-term survival of many ESUs from the upper Columbia Basin will depend upon improvements in ocean and habitat conditions and conditions in the hydropower corridor. For mid-Columbia Basin stocks, it will depend on improvements in ocean conditions and habitat, as well as improvements in the hydropower corridor. For lower Columbia Basin stocks, it will depend on improvements in ocean conditions and habitat. For the sockeye, chinook, and steelhead ESUs considered in this opinion, harvest has been reduced to the point that it is not a major factor limiting recovery of Columbia Basin stocks. Nevertheless, harvest reductions will continue to be a necessary and important contributor to the species' survival through the current bottleneck.

6.0 EFFECTS OF THE PROPOSED ACTION

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA and in 50 CFR §402.02. This section of the Biological Opinion applies those standards in determining whether the proposed fisheries are likely to jeopardize the continued existence of one or more of the threatened or endangered salmon species (ESUs) that may be adversely affected by the fisheries. This analysis considers the direct, indirect, interrelated and interdependent effects of the proposed fisheries and compares them against the Environmental Baseline to determine if the proposed fisheries will appreciably reduce the likelihood of survival and recovery of these listed salmon in the wild.

Critical habitat has now been designated for all of the affected ESUs. While harvest activities do affect passage in that fish are intercepted, those impacts are accounted for explicitly in the following analyses regarding harvest related mortality. Most of the harvest related activities occur from boats or along river banks. Gears that are used include primarily hook-and-line, drift and set gillnets, and hoop nets that do not substantively affect the habitat. Effects to the habitat that may occur include impacts to shoreline areas and habitat through bank fishing, movement of boats and gear to the water, and other stream-side uses. Water quality can also be adversely affected by the proposed fisheries as a result of the release of boat engine products, trash, and other effluents into the water. However, the effects to critical habitat associated with the proposed fisheries are expected to be temporary and localized, particularly given the size and volume of the mainstem Columbia River where most of the proposed fisheries will occur. Impacts to critical habitat are expected to be negligible. Based on these considerations, NMFS concludes that the proposed fisheries will not result in the destruction or adverse modification of any of the essential features of the critical habitat in which these fisheries occur.

The determinations with respect to jeopardy in this opinion are also based on specific consideration of the magnitude and duration of harvest reductions made to date, the proposed management actions taken to reduce the catch of listed fish, the magnitude of the remaining harvest, particularly in comparison to the period of decline, and available risk assessment analyses. Where pertinent, NMFS reviewed the consideration and decisions made during past consultations on these same winter, spring, and summer season fisheries. In general, NMFS sought to develop analyses that considered the status of the species, the environmental baseline, and the effects of the proposed actions, particularly within the context of other harvest activities that are likely to affect the species. NMFS considered the population structure of each ESU when appropriate by reviewing both the status and impacts to components that were considered representative or important to the ESU as a whole. NMFS also considered the analysis and assumptions contained in the recent All-H paper (Federal Caucus 2000) and associated FCRPS opinion (NMFS 2000a). These provided a broader context for considering the impacts associated with a particular action, including those related to harvest, than we have had during past consultations. In general, the analysis contained in the hydro opinion assumed that harvest rates would be held to no more than the already-reduced levels outlined in NMFS' most recent biological opinions for the foreseeable future. For the critical stocks considered in this opinion this effectively capped future harvest rates at recent levels thus providing a benchmark against which to evaluate proposed actions. For the spring component of the SR spring/summer chinook ESU and for UCR spring chinook the harvest rate cap established in the 2000 consultation was 9% (NMFS 2000d). The total harvest rate caps for SR sockeye and SR summer chinook in recent opinions were 8% and 6%, respectively. The harvest rate on each of the steelhead ESUs in the non-Indian fisheries is limited to $\leq$2%. No specific harvest rate limits for steelhead associated with the treaty Indian winter, spring, and summer season fisheries were set in recent consultations. Instead, the harvest rate for upriver chinook and sockeye ESUs were used to set overall fishery limits. Because of the timing of the fisheries, expected incidental impacts to steelhead are generally quite low.

Fisheries may affect salmonid ESUs in several ways which have bearing on the likelihood of continued survival of the species. Immediate mortality effects accrue from the hooking or netting and subsequent retention of individual fish — those effects are considered explicitly in this opinion. In addition, mortalities may occur to any fish which is caught and released. This is important to consider in the development of fishery management actions, as catch-and-release mortalities primarily result from implementation of management regulations designed to reduce mortalities to listed fish through live release. The catch-and-release mortality rates vary for different gear types, different species, and different fishing conditions, and those values are often not well known. Catch-and-release mortality rates have been estimated from available data and applied in the calculation of impacts to listed fish in this consultation. As a result, all harvest related impacts to listed fish associated with the proposed fisheries are accounted for in this opinion.

The TAC developed forecasts for the expected 2001 runs of the chinook, steelhead, and sockeye ESUs and component stocks that may be affected by the proposed fisheries (Table 12). Estimates of the total harvest-related mortality associated with the proposed fisheries are available primarily from the tribes' biological assessment (Speaks 2000), the states' section 10 permit application (Tweit and Norman 2000), and the Joint Staff Report (Joint Staff 2001) prepared by TAC. The Interim Agreement revised the proposed harvest rates for upriver spring chinook stocks and, with respect to the tribal fisheries, for sockeye. These documents in combination, thus characterize the proposed harvest rates. The analysis in this opinion focuses, to some degree, on harvest rates for 2001. However, the consultation also applies to future fisheries so long as they are managed subject to the terms of the Agreement and current fishery proposals.

The ESU specific mortality from the fisheries was estimated in one of two ways. For some stocks (ESU components) or ESUs, the states and tribes have proposed to manage their fisheries for specific target harvest rate limits. For example, the states and tribes will manage their fisheries for upriver spring chinook according to the harvest rate schedule contained in the Interim Agreement. Given the circumstances in 2001, the schedule allows the states a harvest rate of 2% and the tribes a harvest rate of 13%. The allowable harvest rate may change inseason and will almost certainly change from year-to-year. The states and tribes can be expect to manage up to these harvest rate limits since these are the limiting stocks in the fishery.

For other stocks or ESUs, impacts are generally lower and there are no specific management constraints proposed. For example, there are no specific harvest rate limits proposed for steelhead in the tribal fisheries. For these ESUs, estimated impacts are based on recent-year average catches assuming that fisheries will be managed largely as they have in the past. For these ESUs, there are estimates of both the maximum anticipated harvest rates and expected harvest rates based on recent-year average point estimates that better characterize the level of impact that is likely to occur. In this opinion, NMFS uses either the proposed management constraints or the maximum harvest rates to define the limit of expect take, but also considers the more realistic estimates of the expected impact in analyzing the effect on the species. The analysis therefore does not focus only on worst case scenarios associated with maximum anticipated impacts.

6.1 Effects of Tribal Salmonid Fisheries

The tribes proposed specific harvest rate limits for upriver spring chinook stocks, upriver summer chinook stocks, and sockeye salmon. The tribes provide estimates of both the maximum and expected impacts to the steelhead ESUs associated with these fisheries, but do not propose specific harvest rate limits. For 2001 the tribes propose, based on the preseason runsize projections, to limit the harvest rate in their mainstem fisheries on the SR and UCR natural-origin spring chinook to 13%. If the inseason update for the aggregate upriver return changes, the tribes propose to adjust their harvest rate according to the proposed schedule (Table 13). The tribes intend to manage their fisheries conservatively so as not to exceed the prescribed limit as provided for in the Interim Agreement, but can reasonably be expected to manage up to that constraint (Table 14). The expected total catch of upriver spring chinook associated with the tribes' proposed mainstem fishery for 2001 is about 47,000 chinook. This compares to catches that have averaged about 5,300 over the last five years.

Table 12. Preseason run size forecasts for returns in 2001 of salmonid species listed under the Endangered Species Act (Speaks 2000).

Salmonid species/run	Preliminary estimate of run size at Columbia River mouth
Snake River sockeye	105
Upper Columbia River naturally-produced spring chinook	6,300
Snake River naturally-produced spring chinook	39,300
Snake River naturally-produced summer chinook	3,100
Snake River naturally-produced spring/summer chinook	42,400
Lower Columbia River naturally-produced chinook (spring-run)	2,060
Upper Willamette River naturally-produced spring chinook	6,100
Upper Columbia River hatchery-produced steelhead	14,900
Upper Columbia River naturally-produced steelhead	1,600
Upper Columbia River steelhead	16,500
Snake River naturally-produced steelhead	21,600
Mid-Columbia naturally-produced steelhead	19,100
Lower Columbia River naturally-produced steelhead	2,800
Upper Willamette River naturally-produced steelhead	9,000

The tribes propose to manage their fisheries such that the harvest rates on upriver summer chinook not exceed 5%. The tribes' fisheries have been managed under similar guidelines in recent years, but actual harvest rates have been well below those limits. Harvest rates on upriver summer chinook have averaged 1.5% (range 0.4 - 3.1) since 1990. The estimated harvest rate on upriver summer chinook in 2000 was 0.9%. Since the tribes have not proposed to change their management practice for the summer season fisheries from that of recent years, it is reasonable to expect that the actual harvest rates to the summer component of the SR spring/summer chinook ESU will continue to be well below the proposed 5% harvest rate limit.

The tribes' proposed fishery at Willamette Falls would have some impact on UWR spring chinook. However, the fishery depends heavily on flow conditions which are optimal only about once out of every ten or fifteen years (Speaks 2000). The expected catch of UWR spring chinook reflects an expectation that some fishing will occur, but with relatively limited success - 21 chinook per year. The maximum estimate assumes that 300 chinook would be caught in the fishery about 10% of which would be listed fish. The available information suggests that the harvest rate is unlikely to exceed 0.5% in any particular year, and generally will be much lower.

Table 13. Harvest Rate Schedule for Upriver Spring Chinook.

Total Columbia River Mouth Run Size	Snake R. Run Size	Tribal Proposed Harvest Rate	States normal Harvest Rate	Total Harvest Rate	State wild Limited Rate
<25,000	<2,500	5.0%	<0.5%	<5.5%	<0.5%
25,000	2,500	5.0%	0.5%	5.5%	0.5%
30,000	3,000	5.0%	1.0%	6.0%	0.5%
40,000	4,000	6.0%	1.0%	7.0%	0.5%
50,000	5,000	7.0%	1.5%	8.5%	1.0%
75,000	7,500	7.0%	2.0%	9.0%	1.5%
100,000	10,000	8.0%	2.0%	10.0%	
130,000	13,000	9.0%	2.0%	11.0%	
200,000	20,000	10.0%	2.0%	12.0%	
250,000	25,000	11.0%	2.0%	13.0%	
300,000	30,000	12.0%	2.0%	14.0%	
350,000	35,000	13.0%	2.0%	15.0%	
364,600	**39,300**	**13.0%**	**2.0%**	15.0%	
400,000	40,000	14.0%	2.0%	16.0%	
450,000	45,000	15.0%	2.0%	17.0%	

Footnotes:

1. If the Snake River wild forecast is < 7.5% of the total run size the more conservative harvest rate would be used.
2. If the Upper Columbia wild forecast is less than 1000, then the total harvest rate would be restricted to 9% or less.
3. Whenever wild fish restrict harvest to 9% or less, then non-Indian fisheries would transfer 0.5% harvest rate to treaty fisheries. In no event would non-Indian fisheries go below 0.5% harvest rate.
4. In the event the Total forecast is less than 25,000 or the Snake River forecast is less than 2,500, the states would keep their havest rate below 0.5% and attempt to keep the harvest rate as close to zero as possible while maintaining minimal fisheries target in other harvestable species.

The tribes propose to manage their fisheries with respect to sockeye subject to the harvest rate schedule described in the Interim Agreement. The schedule allows for harvest rates of 5% for sockeye runs less than 50,000 and 7% for runs greater than 50,000. For runs greater than 75,000 the proposed harvest rate is 7%, but the tribes may request additional harvest subject to further discussion of the parties. Harvest rates greater than 7% would require a reinitiated consultation. Given the preseason forecast for 2001 the proposed harvest rate is 7% although this would be adjusted inseason as necessary. In recent years, sockeye stocks have been relatively depressed with little directed fishing. The resulting average harvest rate since 1991 is 4.1% (range 2.6% - 6.0%).

The tribes estimate the total catch of steelhead for the winter, spring, and summer seasons, and tributary fisheries separately based on either maximum or recent year average catches or catch rates (e.g., steelhead catch/chinook). The totals for each period then have to be allocated between hatchery and natural-origin stocks and further among the various ESUs. In the winter and spring fisheries, the catches need to be divided further between the kelt and holdover fish and the fresh fish that are actively migrating. The tribes provided estimates of both the maximum and expected harvest rates for each ESU. The expected estimates were based on recent year averages derived from the tribes' biological assessment and some updated analyses (Ellis, S., CRITFC, pers. comm. P. Dygert, NMFS, February 27, 2001). The expected harvest rates for steelhead in the tribal fisheries are lowest for the UWR and LCR ESUs (0% and 1.6%) because they reside either entirely or primarily below Bonneville Dam. The expect harvest rates for natural-origin MCR, SRB, and UCR are 3.6%, 2.7%, and 3.8%, respectivley. The expected harvest rate for UCR hatchery-origin steelhead is 2.7% (Table 14).

As described in the biological assessment, a large portion of the steelhead in the lower Columbia River during the winter and spring fishing seasons is represented by "holdovers" (adults of the 2000-01 run which have not yet entered tributaries to spawn) and "kelts" (which are adults that have already spawned). Little information exists on the spawning success particularly of holdovers, and consequently their contribution to the continued existence of steelhead populations. Since on average 87% of the steelhead vulnerable to in-river winter and spring season fisheries may be holdovers and kelts, the relative reproductive value of these fish is pertinent to the analysis of impacts.

Few data exist to evaluate the relative spawning capability of holdover steelhead. It is the opinion of the majority of TAC members that fish still in the lower Columbia River reaches in February or March are less likely to return and spawn successfully to tributary areas in the UCR or SRB, for example, than fish that made their migration during the peak of the run. Because of the substantial uncertainty on this question, we have counted holdovers and kelts in the total mortality. However, it is useful to consider an example of the implications of this situation. If, for example, few or none of the holdovers contributed to spawning success, as much as 87% of the winter and spring season fishery impacts would be "discounted," as far as the survival and recovery of the ESUs is concerned in the sense that they might not be destined to contribute significantly to the survival of the ESU. The effect of this discounting would be to reduce the expected harvest rates by about 20%. (Steelhead caught in the summer season are not discounted.) So, for example, the expected harvest rate on SR steelhead would be 2.2% rather than 2.7% if the expected catch of kelts and holdover fish is not included. Some further research on this point would be useful.

Table 14. Projected harvest rates in fisheries proposed for the 2001 winter/spring/summer season in the Columbia River on salmonid species listed under the Endangered Species Act. Maximum (Max) refers to the upper limit of proposed impacts. Expected (Exp) refers to a point estimate of expected impacts under proposed fisheries.

ESU	Non-Indian Fisheries		Treaty Indian Fisheries		Total Impacts	
	Max	Exp	Max	Exp	Max	Exp
Lower Columbia River chinook[1]	≤12%	1.5%	0%	0%	≤12%	1.5%
Upper Willamette spring chinook	≤10%	≤10%	0.5%	0%	≤10.5%	≤10%
Upper Columbia spring chinook	≤2%	≤2%	13%	13%	≤15%	≤15%
Snake River spring chinook	≤2%	≤2.0%	13%	13%	≤15%	≤15%
Snake River summer chinook	≤1%	0.1%	5.0%	1.6%	≤6%	1.7%
Snake River spr/sum chinook	<1.9%	<1.9%	12.4%	12.2%	14.3%	14.0%
Snake River sockeye	≤1%	0.9%	7.0%	4.1%	≤8.0%	5.0%
Lower Columbia River steelhead	≤2%	1.2%	4.9%	1.6%	≤6.9%	2.8%
Upper Willamette steelhead	≤2%	0.2%	0.0%	0.0%	≤2%	0.2%
Mid-Columbia River steelhead	≤2%	0.4%	7.7%	3.6%	≤9.7%	4.0%
Upper Columbia River wild steelhead	≤2%	0.6%	7.6%	3.8%	≤9.6%	4.4%
Upper Columbia River Hatchery steelhead	≤6%	4.5%	5.6%	2.7%	≤11.6%	7.2%
Snake River steelhead	≤2%	0.2%	5.7%	2.7%	≤7.7%	2.9%

[1] Spring returning component only. No impacts to fall-returning component are expected in this time frame.

Tribal shad fisheries

Spring and summer chinook salmon may be taken in the treaty Indian experimental shad fishery. While direct mortality effects are fully accounted for and included in the total mortality level for treaty fisheries, there are potentially indirect effects involving passage delay which could lead to additional mortalities. In 1994-1999, the Yakama Indian Nation has explored the feasibility of harvesting shad by conducting experimental fisheries at The Dalles Dam. NMFS has previously recommended that efforts be made to remove shad, an introduced species, from the Columbia River (NMFS 1995a). Fisheries that can successfully target and reduce shad abundance may therefore benefit the listed species in the long run.

Indications from non-treaty shad fisheries conducted in recent years below Bonneville Dam indicate a potential for commercially-viable shad harvest with minimal impacts on salmonids. However, hourly count records from the counting window at The Dalles Dam during the 1995 treaty experimental shad fishery suggested that fallback of salmonids was occurring at a higher rate when the fishery was in operation than at other times. Information is not available on the length of time individual fish are deterred from passing because of the fishery, whether they use another ladder or ladder exit, or what magnitude of fitness or survival impacts these fish undergo. The possibility that these effects are large, possibly resulting in degradation of a significant portion of the run (including listed fish), is cause for concern. Starting in 1996, the Yakama Indian Nation has conducted discussions with NMFS, the U.S. Army Corps of Engineers, and the Fish Passage Center to design experimental shad fisheries, with the intent to collect data on fishery operation and configuration with regard to salmonid passage and mortality concerns. It is expected that any such fishery will be implemented only at The Dalles Dam, though one other site may be explored. For the purposes of the jeopardy analysis in this Opinion, NMFS assumes that the 2001 shad fishery will be operated in a manner similar to the fisheries implemented in recent years, that passage delay effects will be closely monitored, and that indirect effects to listed salmon from the operation of the experimental treaty shad fishery are negligible. All observed and reasonably-estimated direct impacts to salmon will be included in the calculation of total treaty Indian fishery impacts.

6.2 Effects of State Salmonid Fisheries

The states of Oregon and Washington propose to manage state fisheries as described in their permit application and modified by the Interim Agreement. The harvest rate for listed, natural-origin UCR and SR spring chinook will be determined annually and inseason by the harvest rate schedule (Table 13). Given the circumstances in 2001, the schedule allows for a harvest rate $\leq$2%. Harvest rates for SR summer chinook and SR sockeye, in the proposed stated fisheries, are limited by harvest rates $\leq$1%.

The states proposed to manage their fisheries subject to a harvest rate limit on listed, natural-origin steelhead of $\leq$2%. Proposed harvest rates on hatchery-origin UCR steelhead are higher (6%) because marked hatchery fish are generally retained in the states' selective recreational fishery. Based on past observations, the expected harvest rates on steelhead are generally lower than the prescribed limits (Table 14).

There are no specific harvest rate limits for the spring component of the LCR chinook ESU. The states manage their terminal area fisheries to achieve hatchery-origin escapement goals. Maximum harvest rates may be as high as 12%, but the expected harvest rates in the proposed fisheries are expected to average closer to 1.5%.

Harvest impacts on UWR spring chinook are tabulated here, in part, for the sake of completeness, and, in part, because there are some potential impacts to UWR spring chinook in tribal fisheries. However, as described earlier, all impacts to UWR spring chinook in state freshwater fisheries have been considered and approved through the recently developed 4(d) Rule process and are therefore not considered in detail in this consultation.

The states will likely implement selective fishery regulations in both the sport and commercial fisheries that require the release of unmarked steelhead and chinook. Impacts associated with the catch-and-release of unmarked fish will be included in the total harvest rate estimates. Although the states have managed their steelhead sport fisheries using selective regulations for some time, this will be the first year that the mainstem sport fisheries for chinook will also be selective. The purpose is to maximize the harvest of unlisted hatchery fish within the restrictive limits on listed fish. The selective sport fishery is possible for the first time this year because of the mass marking programs that were initiated a few years ago. The proportion of marked hatchery fish returning is now high enough to make the selective harvest programs feasible.

This will also be the first year that the states will implement selective commercial fisheries for chinook. The release of all steelhead caught during commercial fisheries has been required by the states for some time. The states' commercial fishery in 2001 will be used to help evaluate the handling mortality of released fish and best practices for the use of selective tooth nets. Marked hatchery fish will be retained in the fishery. All unmarked fish will be released. Harvest-related mortality associated with this selective commercial fishery will count against the non-Indian catch allocation.

6.3 Warmwater Recreational Fisheries

Steelhead smolts may generally be taken in warmwater fisheries such as those described in the biological assessment. Based on available information from creel surveys, TAC determined that "impacts to listed steelhead smolts [associated with the proposed fisheries] are expected to be minor." TAC does not further assess impacts to steelhead with regard to the take of steelhead juveniles; however, NMFS expects that the impacts to juvenile steelhead will be negligible.

6.4 Research, Monitoring, and Evaluation Related to Selective Fishery Implementation

Also considered in this consultation are research, monitoring, and evaluation activities associated with the fisheries that are necessary to minimize anticipated incidental take resulting from implementation of selective fisheries. The activities proposed for 2001 are the first step in what is expected to be an aggressive program to further develop selective fisheries strategies which are designed, in part, to reduce impacts on listed ESUs. Generally these activities will be designed to meet the objectives of Actions 164 and 167 that are specified in the Reasonable and Prudent Alternative of the recent FCRPS biological opinion (NMFS 2000a). The Actions specify, in part, that the management agencies develop:

"... a multiyear program to develop, test, and deploy selective fishing methods and gear that enable fisheries to target nonlisted fish while holding incidental impacts on listed fish within NMFS-defined limits. ..." and,

"... improved methods for estimating incidental mortalities in fisheries, with particular emphasis on selective fisheries in the Columbia River basin, ..."

There will, at times, be fisheries that also have an associated monitoring and evaluation function related to the above described objectives. For the purpose of assessing and assigning impacts, it is necessary to make a distinction between fishing activities that are subject to the overall take and allocation limits defined in this opinion, and research and monitoring activities that are not. If fish are retained for sale or for uses other than those specifically related to purposes or support of the research, then the activity would be considered a fishery and the associated mortality would count against the prescribed, species-specific, harvest rate limits. Research activities are those designed primarily to address the above described objectives. There may be some mortality or take associated with these research activities. However, the take will generally be small and intended to provide necessary information that will benefit the conservation and recovery of the species.

In 2001, the states of Oregon and Washington proposed activities that fit into both the fishery and research categories. One of the projects is an experimental gear permit fishery intended to evaluate the effectiveness of 3½" and 4½" tooth nets in capturing spring chinook. Short-term mortality associated with use of these nets will also be assessed. All unmarked fish will be released, but fishermen will retain marked fish for sale to offset their costs of participation. Impacts associated with this fishery will count against the states' over all harvest rate limits. Three additional projects proposed for 2001 are considered research. These are designed to compare: 1) the long-term survival rates of spring chinook captured with 3½" tooth nets and conventional gill nets; 2) the effect of soak time on short-term survival of spring chinook captured with 3½" tooth nets and conventional gill nets, and 3) the effectiveness of a floating trap in capturing spring chinook. During these projects, all fish will be released except those needed for assessing post-release mortality (Joint Staff 2001). These projects are all designed to refine the selective fishery methods and/or provide better estimates of the effect on fish that are caught and released. The expected rate of mortality to listed upriver spring chinook stocks associated with these projects is approximately 0.2%. Steelhead would likely be subject to a similar rate of mortality.

The research program being initiated in 2001 is intended to be the start of a multi-year effort. The research will presumably continue in future years during the term of this biological opinion. Mortality associated with the research will be kept to a minimum, but, in order to provide an upper limit of impacts, may not exceed an annual rate of 0.5% to any natural-origin component of a listed ESU.

7.0 CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." No such effects are anticipated. Future Federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being or will be reviewed through separate section 7 consultation processes. In addition, non-Federal actions that require authorization by NMFS under section 10 of the ESA will be evaluated in section 7 consultations. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Generally, NMFS expects continued population growth in the interior Columbia Basin with decreasing use of water for agriculture and increasing use for municipal and industrial purposes. It is difficult to speculate what impact this may have on salmon habitat. In the area of state forest practices, Washington is proposing to strengthen its rules, which will contribute significantly to habitat protection. While Oregon has recently adopted stronger rules, NMFS still considers them inadequate to provide properly functioning watershed conditions. A proposed U.S. Department of Agriculture program funded under the Conservation Reserve Enhancement Program would purchase conservation easements along salmon-bearing streams. Although this is a promising program, the proposed easements would only last 15 years and so are not expected to provide substantial long-term benefits. These future state and private land management actions are likely to occur, but it would be too speculative to attempt to quantify their impacts.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

8.1 Chinook Salmon

8.1.1 Snake River Spring/Summer Chinook and Upper Columbia River Spring Chinook

<u>Background</u>
The circumstances related to SR spring/summer chinook and UCR spring chinook clearly present the most difficult questions in this consultation and so merit a more substantive review of the facts and considerations. A review of the record of sequential harvest reductions over past years provides pertinent perspective about harvest-related management actions that have been taken in past years to protect upriver, natural-origin spring chinook stocks.

Upriver spring chinook stocks, including those from the UCR spring chinook ESU and the spring component of the SR ESU, were subject to substantial harvest through the early seventies. The average harvest rate on upriver spring chinook from 1938-1973 was 55%. As the stocks declined it became apparent that they could no longer support those kinds of harvest rates. As a result, the spring season fisheries that targeted upriver stocks were largely eliminated by the state and tribal managers. Upriver spring chinook were last targeted in the mainstem fisheries in 1977. Harvest rates in all mainstem commercial, recreational, and C&S fisheries have averaged just over 8% since then (Figure 4).

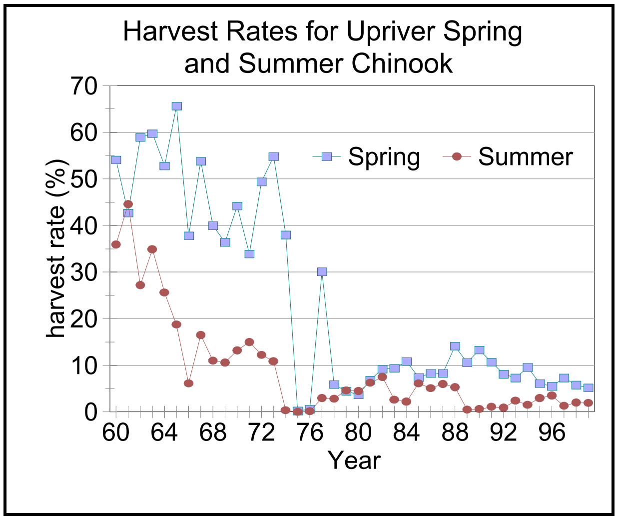


Figure 4 Harvest rates for all commercial, recreational, and C&S fisheries in the mainstem Columbia River

The last mainstem fisheries targeting upriver summer stocks that are also part of the SR ESU occurred in 1964. Harvest rates have not exceeded 10% since 1973 and have averaged less than 3% since 1974. Harvest rates over the last 10 years have averaged less than 2%.

In recent years the CRFMP provided a framework for managing the mainstem fisheries that impact upriver spring and summer chinook stocks. The purpose of the Plan was to define harvest limits that would be sufficiently protective to allow for rebuilding of the stocks of concern. The Plan was formally approved in 1988, but fisheries were managed subject to its provisions beginning in 1986. The Plan allowed for harvest rates up to 4.1% on upriver spring stocks in non-Indian fisheries and either 5% (for aggregate runs less than 50,000) or 7% (for runs between 50,000 and 128,800) in treaty Indian C&S fisheries. (128,800 is 112% of the 115,000 interim management goal as measured at Bonneville Dam.) For runs greater than 128,800, half the surplus greater than 128,800 was considered harvestable in mainstem fisheries. The Plan also provided that all fish in excess of 143,750 were harvestable. Last year was the first year since 1977 that the aggregate upriver return was expected to exceed 128,800. The preseason forecast in 2000 was 134,000; the actual return was 178,600. (For comparison, the forecast for upriver spring chinook for 2001 is 364,600.)

The Plan is important because it reflects the parties' understanding almost thirty years ago that the kind of harvest rates that were in place at the time could not be maintained and that action wa needed to reduce harvest levels to what were arguably very low levels. During the mid-80s when the Plan was being developed, the parties made a more explicit determination about the level of harvest that was appropriate and acceptable during what presumably would be a rebuilding period. It made explicit state/tribal allocation decisions and confirmed that the tribes were prioritizing the use of the available harvest for C&S purposes. The Plan contemplated higher harvest rates on spring stocks only if the aggregate return exceeded 128,800 (112% of the interim management goal of 115,000). The Plan set an interim management goal of 25,000 natural-origin spring chinook as measured at Lower Granite Dam. Although the Plan specified that the interim goal was limited to the purpose of managing fisheries in the Snake Basin and therefore would not affect mainstem harvest rates, it nonetheless provides useful perspective about the parties' views of desired condition for the natural-origin stocks at the time the Plan was developed.

Prior Consultations

Despite the Plan's provisions, additional constraints were implemented in 1992 when SR spring/summer chinook stocks were first listed. These were refined through a series of annual consultations that led to the development in 1996 of a three year Management Agreement that modified the Plan's original harvest management framework (U.S. v. Oregon 1996, Table 15)[1]. The Plan provisions were modified by reducing allowable impacts in the non-Indian fisheries. The alternative target harvest rates in the treaty Indian fisheries (5%-7%) were not changed as a result of the Agreement, but the Agreement did, for the first time, require that fisheries be managed in response to the status of listed natural-origin fish rather than an aggregate runsize that was now composed primarily of hatchery-origin fish. The Agreement provided that harvest rates would match those of the original Plan only if the anticipated return of natural-origin spring chinook from the SR exceeded 10,000 fish. The 10,000 fish bench mark was designed to approximate the run necessary to meet the BRWG threshold escapement levels (Table 15). The Agreement left unresolved what would happen if the aggregate return was greater than 115,000 and the return of natural-origin SR spring chinook was greater than 10,000. There were no similar bench marks developed for UCR chinook because they were not listed in late 1995 when the Agreement was being developed.

[1]The 1996-1998 Agreement was subsequently extended through July 31, 1999.

Table 15. Harvest rate schedule for spring chinook salmon in a) non-treaty and b) treaty fisheries for Columbia River Zones 1-6 from the 1996-1998 Management Agreement (U.S. v. Oregon 1996). Run sizes are returns to the mouth of the Columbia River.

a. Non-Indian fisheries					
Select more conservative of:		Harvest rate based on Willamette spring chinook run size			
Aggregate upriver spring chinook salmon run size	Snake River naturally-produced spring chinook salmon run size	<50,000	50,000-75,000	75,000-100,000	>100,000
< 50,000	< 5,000	1%	1%	1%[†]	†
50,000-115,000	5,000-7,500	2%	2%	< 2.5%	†
50,000-115,000	7,500-10,000	2%	2%	< 3%	†
< 115,000	> 10,000	CRFMP Guidelines			
> 115,000	> 10,000	†	†	†	†

b. Treaty Indian fisheries		
Select more conservative of:		
Aggregate upriver spring chinook salmon return	Snake River naturally-produced spring chinook salmon return	Harvest Rate
< 50,000	< 5,000	5%
50,000-115,000	5,000-10,000	7%
< 115,000	> 10,000	CRFMP Guidelines (5% or 7%)
> 115,000	> 10,000	†

[†] Further discussion by the parties.

The CRFMP limited harvest rates on upriver summer chinook stocks in the non-Indian and treaty Indian fisheries to 5% each. The three-year Agreement reduced the harvest rate limit for upriver summer chinook in the non-Indian fishery from 5% to 1% and clarified that all treaty Indian fisheries were subject to the 5% harvest rate limit. These limits on summer chinook harvest were not particularly confining since both the states and tribes had been managing their fisheries well below these limits anyway.

For summer stocks, the Plan simply capped the harvest rates and put off consideration of when to increase those rates until circumstances changed. Unfortunately, the status of the natural-origin spring and summer stocks has not improved despite over thirty years of very conservative harvest management.

Provisions of the Plan and associated Management Agreement were considered in detail through an intensive consultation process and in the associated biological opinion that was completed in 1996 (NMFS 1996a). During its analysis of the Management Agreement, NMFS sought, among other things, to assess whether the Agreement was consistent with principles articulated in its Proposed Recovery Plan for Snake River Salmon (PRP) (NMFS 1995a). The draft plan was published in April 1995 and so was pertinent to the consideration of the three year Agreement. Although the PRP was never finalized, the principles articulated there were still valid.

The PRP recognized that the harvest rates affecting spring and summer chinook stocks had already been greatly reduced, leaving relatively little opportunity to aid recovery through further reductions. Notwithstanding the conservation actions taken up to that point, NMFS concluded that the status of the listed species was such that harvest had to be reduced and maintained at low levels until actions to improve other life stages took effect. It was apparent then that critical threshold escapement levels for spring/summer chinook salmon that had recently been identified by the BRWG (1994, Table 4) would not be met in the near term, even in the absence of all harvest. As a result, a primary objective articulated in the PRP was to define minimized fishery levels that would be necessary for the foreseeable future, recognizing that expanded harvest needed to be tied to the status of the listed species. Minimized fisheries were defined as harvest levels necessary for conservation when even minimum biological objectives cannot be met. At the time, minimized fisheries were recommended that prioritized, to the degree possible and consistent with the conservation needs of the species, C&S opportunity for tribal fisheries and limited impacts that occur incidental to fisheries directed at other species or stocks. (We note briefly here, and in more detail later, that these same principles were reiterated and affirmed in the recent All-H paper.)

The conclusion in the 1996 opinion was that the 1996-1998 Management Agreement was consistent with the principles outlined in the PRP. Despite successive reductions made in past years that were recognized in the opinion, the Agreement reduced harvest further to what NMFS accepted as minimum levels. These were considered consistent with the conservation needs of the species while providing for tribal C&S opportunity that had been defined by the tribes themselves during development of the CRFMP as an appropriate response to a significant conservation need. The minimized fishery levels also included extremely limited impacts that occurred incidental to state fisheries directed at other species or stocks. The Management Agreement augmented the Plan in that it established management objectives that were tied directly to the status of the listed species. NMFS considered this a necessary and fundamental change from the CRFMP which generally managed based on aggregate runsize rather than the status of natural-origin stocks. This is particularly important when, as is the case this year, the natural-origin stocks of concern comprise less than 13% of an aggregate run that is composed primarily of hatchery-origin fish. NMFS concluded that the low harvest rates allowed under the Agreement provided substantial protection for the listed species, and would be necessary until improvements affecting other life stages took effect.

Since the Management Agreement was last reviewed there have also been several additional listings. Upper Columbia River spring chinook are listed as endangered and are subject to the same mainstem harvest rates as the spring component of the SR ESU, thus multiplying the concerns related to spring season harvest. In fact, the endangered status of the listed UCR spring chinook accurately reflects the more precarious status of that species. Two additional chinook ESUs from the Columbia Basin are now listed, including LCR and UWR chinook, although these are generally subject to lower harvest impacts because of their location in the lower river. There are also now five listed steelhead ESUs in the Columbia Basin. Although most steelhead harvest, particularly in upriver ESUs, occurs in the fall season fisheries, some impacts occur in these fisheries as well. If the upriver spring chinook stocks are the limiting stocks in a harvest management context, then allowing higher impacts to SR or UCR spring stocks as proposed will result in higher impacts to some or all of the other ESUs as well.

<u>Related Developments in 2000</u>
The circumstances changed in 2000. The 1996-1998 Management Agreement was extended through 1999, but was not applicable in 2000 so there was no longer an agreed management structure. In addition, there was a preseason forecast for upriver spring chinook of 134,000 that was generally higher than it had been for some time. Based on the higher aggregate run size, the tribes proposed a harvest rate for spring chinook of 9% while the states proposed a harvest rate ranging from 1-2%. Despite intensive negotiation that ensued through the consultation period and for reasons articulated in the biological opinion (NMFS 2000d), NMFS concluded that an increase in the harvest rate beyond 9%, no matter how small, was inappropriate given the status of the stock. NMFS issued a jeopardy opinion and limited the overall harvest rate to 9%.

One further event that is relevant to this years' consultation was NMFS' issuance of the biological opinion on the FCRPS and the associated Basin-Wide Salmon Recovery Strategy, generally referred to as the All-H paper. These documents, in combination, provided two things: first, a uniform analytical structure for assessing the status and likelihood of survival and recovery for all of the listed ESUs in the Basin; and second, an integrated recovery strategy that set limits and performance standards for all actions affecting the listed species (including harvest) that will be implemented over the next ten years. The All-H Strategy called for harvest to be capped at the levels outlined in the most recent biological opinions. In the case of SR and UCR spring chinook, the intended harvest rate cap is 9%.

Importantly, the All-H paper also provided a broader context for consideration of harvest-related mortality that affirmed and amplified the themes articulated in the original PRP. The paper affirmed that conservative management policies were essential for an interim period while survival improvements are made in other sectors, but recognized that at some point further reductions in harvest were unlikely, by themselves, to result in recovery. The All-H paper also recognized and articulated: 1) the need to balance the conservation of at-risk species with the Federal government's trust obligations to Indians, 2) the priority of tribal fishing rights, particularly with respect to non-Indian fisheries, 3) a willingness to accept a level of risk associated with tribal fishing greater than the biology might strictly imply, and 4) the idea that there is an "irreducible core" of tribal harvest that is so vital to the treaty obligation that the federal government will not eliminate it (an elaboration of the minimized fisheries concept from the PRP). The All-H paper took all of these factors into consideration when it established the 9% harvest rate cap for fisheries affecting SR and UCR spring chinook. The 9% cap was then assumed in subsequent analyses related to the FCRPS biological opinion and thus became one of the underlying assumptions related to its conclusions. This then provided the bench mark against which subsequent harvest proposals had to be compared.

We now come to our consideration of this years' proposals and circumstances which the preceding discussion intended to place in perspective.

The 2001 Forecasts

We first consider the forecast information, and then the harvest proposals and their relation to the bench marks established in the All-H paper. This year's return, if it materializes as predicted, will be unprecedented. The aggregate forecast of 364,600 spring chinook would be twice what it was last year and three times what it has been in prior years going back to 1979. In fact, it would be the largest return since counts began at Bonneville Dam in 1938. The expected return of natural-origin SR spring chinook (39,300) would also be more than twice that seen since 1979. The predicted return of natural-origin UCR spring chinook (6,300) is not a record, but would still represent a substantial improvement over the contributing brood years and the escapements observed over the last 10 years (see Speaks 2000 for applicable tables). It is these unprecedented circumstances that motivated the tribes in particular to propose higher harvests.

There is always uncertainty associated with preseason forecast, but the 2001 forecasts must be considered more speculative than usual. As discussed in section 4.3, the forecasts all rely on the number of jacks (precocious males that return after one summer in the ocean) observed in the prior year to predict age 4 fish that will return in 2001. (Virtually all of the expected return are 4 year old fish.) The jack returns in 2000 were records, in fact two or three times higher, in some cases, than prior years. Predictions made beyond the range of observation are inherently uncertain. The underlying assumption here is that a relatively constant proportion of a surviving brood year return as jacks. The bigger the jack return, the bigger the return of adults in the following year. Alternatively, the large jack return could also be explained if there was a change in the average maturation rate so that a higher proportion of the surviving fish returned as jacks. If the maturation rates were affected by the generally improved survival conditions, than the adult returns may be substantially less than forecast. It is perhaps relevant to note here that there was a large jack return in 1999 that was used to predict a substantial return of fish in 2000 and the return was actually higher than expected. So in 2000, at least, the jack forecasts were actually a bit conservative.

There is an additional concern with respect to the UCR forecast. Available information suggests that using Priest Rapids Dam counts as an index of the wild run size may be biased since the counts are often substantially higher than the cumulative counts of wild fish on the spawning grounds (see section 4.3). WDFW staff provided a set of alternative forecasts based on redd counts that were substantially lower than those provided by TAC. However, TAC did not review the WDFW forecasts and has not had time to review the suggested problems with the UCR database. This is work that needs to be done, but in the meantime, TAC continues to provide consensus technical information for the U.S. vs Oregon parties. Concerns about forecast uncertainty are a consideration, but we nonetheless must manage using the best available information and so for the time being must rely on the estimates provided by TAC.

Fishery Proposals and the Interim Agreement

The original state and tribal fishery proposals generally noted that the predicted returns this year were unprecedented in size, and therefore provided an unexpected opportunity to consider an increased measure of harvest while still allowing most of the benefits of the larger run to accrue to escapement. The states proposed fisheries subject to a 2% harvest rate limit on listed wild SR and UCR spring chinook stocks. The tribes proposed a harvest rate schedule that was tied to the aggregate abundance of upriver stocks. Given the forecast for 2001, the proposed harvest rate on upriver spring stocks for the tribal fisheries was 13%. The tribes' proposal provided that the allowable harvest rate would change according to the harvest rate schedule if inseason information indicated a change in run size and so, to the degree possible, was self-adjusting for forecast uncertainty. Both the state and tribal proposals originally applied only to the 2001 fishery.

NMFS agreed generally that the forecasts were unexpectedly large and well beyond what was anticipated, and that perhaps there was room to consider some additional harvest. NMFS has generally advocated for abundance-based management and therefore saw some positive elements in the tribal proposal. NMFS was also aware of the states' and tribes' efforts to resolve some difficult allocation issues that have brought considerable uncertainty to the management process particularly since the CRFMP expired. The circumstances this year therefore provide a unique opportunity to resolve difficult problems by implementing an agreement that would cover fisheries for the next several years. There is also a clear, if indirect, conservation benefit associated with a long-term resolution of harvest issues in that it would free up the managers to focus directly on more productive conservation actions. However, the standard articulated in the All-H paper and assumed during the analysis associated with the FCRPS opinion was that harvest rates would be fixed at 9% for the foreseeable future. This was, in effect, a jeopardy standard. To avoid implicitly reallocating necessary survival improvements to other sectors that were assumed during the analysis associated with the FCRPS, it is necessary to consider whether the proposed agreement is at least as protective as a fixed 9% harvest rate. From that perspective, if a higher harvest rate is allowed in 2001, then there are three necessary conditions. First, the agreement must be multi-year; second, it has to provide for harvest that would be both lower and higher than 9% and be at least as protective over the long term as a fixed 9% harvest rate; and third it has to provide protection specifically for listed wild stocks. NMFS is not satisfied that aggregate stock management, by itself, is adequately protective of listed fish when the listed fish comprise only a small total of the total run.

The resulting Agreement, tentatively reached pending consultation, is reflected in Table 13 (U.S. vs Oregon Parties. 2001). We therefore must analyze Table 13 and the associated Agreement against the above defined standards.

NMFS' Consideration of the Proposed Fisheries

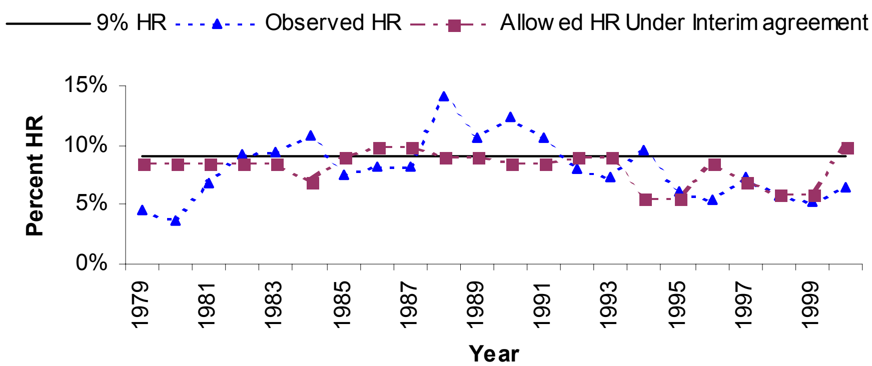
The first consideration was the duration of the Agreement. The tradeoff for somewhat higher harvest rates in 2001 is that there must be certainty that the conservation benefits (i.e., harvest rate lower than 9%) will apply if run sizes in the out years are more similar to what they have been over the last decade, i.e., lower than 9%. Although the allocation provisions of the Agreement are in place only for the first three years, the parties have committed to manage subject to the total harvest rate limits for five years. Although the parties have not committed to use this schedule beyond 2005, it is also reasonable to expect, given the status of the stocks and evolution of management principles over the last ten or fifteen years, that this schedule, or something very similar, will continue to apply in the future as well. It is too early to predict whether the dramatically higher survival rates that affected the broods returning last year and particularly this year will continue. However, escapements in 1998 and 1999 (the primary contributors to the 2002 and 2003 returns) were generally quite low, particularly those in the aggregate run and in the UCR. Further it is the outmigration from the 1999 brood that will be affected by the very dry conditions we are currently experiencing in 2001. The 1999 brood fish will return primarily in 2003 as 4-year olds. The benefit of the five year agreement is that it is easily foreseeable that harvest rates will be even lower than 9% in the future and possibly as soon as next year. NMFS is therefore satisfied that the duration of the Agreement is sufficient.

NMFS' second consideration was whether the Interim Agreement provided for harvest that was both lower and higher than 9% and was at least as protective over the long term as a fixed 9% harvest rate. NMFS interest in seeing rates lower than 9% in years of lessor abundance is based on the recognition that spawners are generally more valuable biologically when they are more scarce. Thus a higher rate in more abundant years is a good tradeoff for lower rates in years of less abundance.

The harvest rate schedule does provide for harvest rates that range from < 5.5% up to 17%. However, based on the schedule, harvest rates higher than 10 or 11% are unlikely unless there is a significant improvement in the status of the stocks. Harvest rates greater than 10% are allowed only when the aggregate run is greater than 130,000 and when the SR wild run is greater than 7.5% of the aggregate run, a circumstance that occurs this year for the first time since 1979. If there is a sustained improvement in stock status, then modestly higher harvest rates will be less of a concern. So, the Agreement does provide for a reasonable range of harvest rates around the 9% benchmark.

We can get some further perspective about how the harvest rate schedule will perform by considering what harvest rates would have been had the schedule been applied in past years. Figure 5 compares the actual harvest rates with the scheduled harvest rates derived from the Agreement since 1979. The average harvest rates over this time period are nearly identical (8.1% vs 8.2%). Under the schedule, harvest rates greater than 9% would have been allowed for in only three of the last 22 years (all would have been 10%), again highlighting the exceptional nature of the 2001 circumstances and the proposed 15% harvest rate.

FIGURE 5. Observed Harvest Rate (HR) and HR Allowed Under Interim Agreement



It is also pertinent that actual harvest rates are often less than those that are allowed under this sort of fixed harvest rate management system. Because fisheries must close once the cap is reached, managers tend to manage carefully as they approach the limit, knowing that otherwise late season fishing opportunities can be lost. Use of a conservative inseason management philosophy is specified as a term in the Interim Agreement. In 2000, for example, the harvest rate cap was 9%; the actual harvest rate was 6.5%. In some years actual harvest rates do exceed those specified, but this occurs most often if the run size drops below expectations late in the season or even as a result of the post season analysis. Under these circumstances catches that were considered within the harvest rate limit based on a presumed run size may ultimately exceed the cap. However, conservative management will lead, over the long term, to harvest rates that are generally lower than those allowed further supporting the conservative nature of the proposed harvest rate schedule relative to a fixed 9% rate.

NMFS' third consideration was whether the Agreement adequately protected listed fish. The tribes originally proposed a harvest rate schedule that was tied only to the total aggregate run size. They argued that this was generally protective of wild stocks because, at least in the short term, the wild stocks tend to be correlated with total abundance. The tribes also advocated for the use of the aggregate run, arguing that because their treaty right is based on the total run, it should not be limited by the status of the listed fish. NMFS originally advocated for a harvest rate schedule that was tied directly and solely to the status of listed natural-origin SR spring chinook and UCR spring chinook. The ultimate Agreement was a compromise of these two points of view. However, it is still necessary to demonstrate that the Agreement adequately protects the listed and is not unduly influenced by the use of the aggregate run, which remains a key element of the harvest rate schedule.

NMFS concludes that the proposed schedule is adequately protective and in some ways may actually be a better alternative to one that is related only to the listed fish. First of all, the harvest rate schedule really has two purposes. It allows the managers to set a target harvest rate each year based on the preseason forecasts of wild stock and aggregate abundance. However, the schedule is also used inseason to adjust the allowable harvest rates. Although we predict wild and aggregated run sizes preseason, we can only update the aggregate run size inseason. Inseason updates are based on counts of fish as they cross the dams. While the total number of fish can be counted at the dams, we can not routinely distinguish hatchery from wild fish. As a result, we must assume that, if the total run size changes inseason, the wild run will also change proportionally. Continued use of the aggregate run as part of the harvest rate schedule therefore recognizes the reality that we must depend on the aggregate for inseason adjustments of run size.

Examination of the harvest rate schedule suggests that the first controlling factor for harvest rate is the aggregate abundance. Wild SR and UCR abundance do not affect the harvest rate unless they are less than 7.5% of the total run or less than 1,000 fish, respectively. This in a sense limits if and when wild stocks control. On the other hand the aggregate stock abundance is, under circumstances seen several times in the past, at least as restrictive as the wild stock abundance would otherwise be. Inclusion of the aggregate stock criterion therefore adds another gate that will tend to restrain harvest over time.

Table 16 was developed to synthesize the net effect of the using both the aggregate run and the SR wild run to control harvest. The Table shows a matrix of run sizes for SR (ranging from 1,000 - 20,000) and for the aggregate run (ranging from 10,000 to 200,000). The matrix elements are then filled with the harvest rates that would result given these combinations of run size. Shaded areas in the upper right of the matrix are those areas that are controlled by the aggregate run size and that are *more* restrictive than if only SR abundance controlled. Shaded areas in the lower left are the allowable harvest rates that are controlled by the SR abundance because the SR run comprise less that 7.5% of the aggregate run. Cells that are not shaded that run down diagonally from left to right are those areas where the aggregate and SR abundances would allow for the same harvest rate. The few cells along the diagonal that have diagonal shading, are the only circumstances where the limitation on the applicability of the SR abundance (recall SR abundance only controls harvest when in is less than 7.5% of the aggregate) leads to a harvest rate that is higher than if SR wild abundance controlled regardless of its relative run size. The net effect is that by using both the aggregate and SR wild stocks to control harvest as proposed in the Agreement, the allowable harvest rates are almost always at least as restrictive as they would be if SR was the only determining factor, and are often even more restrictive because of limitations imposed by the aggregate run size (the shaded upper right hand corner). Although not depicted in Table16, the status of the UCR run provides another layer of conditions that serves to cap harvest at 9% or less.

Table 16. Harvest rate allowed under the Interim Agreement depending on aggregate and Snake River wild run sizes. Shaded areas show which run is more restrictive and thus controls the allowable harvest rate (see legends). Areas with no shading indicate run size combinations where the aggregate and Snake River runs lead to the same result. The numbers shown in bold are approximate run size combinations observed since 1979. For example, in 1980 the aggregate and Snake River runs were approximately 50,000 and 13,000, respectively (see Table 5)

Aggregate Run Size	Snake River Wild Run Size																			
	1000	2000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	20000
10,000	**<5.5**	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%										
20,000	<5.5	**<5.5**	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%	<5.5%
30,000	<5.5	<5.5%	**6.0%**	6.0%	6.0%	6.0%	6.0%	6.0%	**6.0%**	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
40,000	<5.5	<5.5%	7.0%	7.0%	7.0%	7.0%	**7.0%**	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
50,000	<5.5	<5.5%	**6.0%**	8.5%	**8.5%**	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	**8.5%**	**8.5%**	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%
60,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	**8.5%**	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%
70,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%	**8.5%**	8.5%	8.5%
80,000	<5.5	<5.5%	6.0%	7.0%	8.5%	**9.0%**	9.0%	**9.0%**	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
90,000	<5.5	<5.5%	6.0%	7.0%	8.5%	**8.5%**	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	**9.0%**	9.0%	**9.0%**	9.0%	9.0%	9.0%	9.0%
100,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	10.0%	10.0%	10.0%	10.0%	**10.0%**	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
110,000	<5.5	<5.5%	6.0%	**7.0%**	8.5%	8.5%	**8.5%**	9.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
120,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	10.0%	10.0%	10.0%	**10.0%**	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
130,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	11.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
140,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
150,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
160,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
170,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
180,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
190,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	10.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
200,000	<5.5	<5.5%	6.0%	7.0%	8.5%	8.5%	8.5%	9.0%	9.0%	10.0%	10.0%	10.0%	11.0%	11.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%

Aggregate Run More Restrictive Than SnR

Snake River <7.5% and More Restrictive Than Aggregate

Aggregate Less Restrictive Than if SnR Was Driver

NMFS did have some concern about the protection provided by the Interim Agreement to UCR spring chinook. The abundance of UCR spring chinook controls harvest directly only for run sizes less than 1,000 fish, which is a very low run. However, NMFS concludes that the Agreement as a whole does provide necessary protection to UCR spring chinook. Recall that the benchmark for comparison is a fixed harvest rate cap of 9% that was adopted through the All-H paper. The 1,000 fish limit does provide some protection from harvest rates above 9% when UCR chinook are very depressed. However, harvest rates will be controlled, in most circumstances, by the aggregate or SR wild run sizes. The above analyses suggest that harvest rates higher than 9% are unlikely to occur very often until the status of the stocks are generally improved. Harvest rates above 9% are allowed only when the aggregate run is greater than 100,000 and the SR wild run is greater than 7.5% of the aggregate a circumstance that has occurred in just three of the last 22 years. Over the last 10 years the UCR wild run size has correlated significantly, if not strongly, with both the aggregate and SR wild run sizes ($r2 = 0.43$, $P= 0.04$, $r2 = 0.40$, $P = 0.05$). Because of these correlations, it is unlikely that harvest rates greater than 9% would be allowed when the UCR wild run was not up generally as well. For these reasons NMFS is satisfied that the Agreement provide the necessary protection of UCR spring chinook.

The Agreement also establishes harvest rate limits for summer chinook stocks, including those returning to the SR. Non-Indian and treaty Indian fisheries are limited by the Agreement to harvest rates of <1% and 5%, respectively. These harvest rates are the same as those used in recent consultations and are consistent with assumptions contained in the All-H paper. Actual harvest rates have been substantially less than the allowable limits, averaging less than 2% over the last 10 years.

NMFS concludes that the Interim Agreement is at least as protective of listed SR spring/summer chinook and UCR spring chinook as the 9% harvest rate cap that was developed in the All-H paper and assumed in the analysis related to the FCRPS biological opinion. Based on the above described consideration, NMFS further concludes that fisheries managed in 2001, and in future years, as proposed and modified by the terms of the Interim Agreement are not likely to jeopardize the continued existence of SR spring/summer chinook or UCR spring chinook.

8.1.2 Lower Columbia Chinook Salmon

The determination for the LCR ESU is based on several consideration. Impacts to the ESU are low with an expected harvest rate of 1.5%, and limited to the spring component of the ESU. The larger components of the ESU, including the tule and bright stocks have a fall return timing and are thus not caught in the fisheries considered in this opinion. (Likewise, there are no additional impacts to spring stocks in the fall season fisheries.) All of the three remaining spring chinook stocks in the LCR chinook ESU are supported by associated hatchery programs since dams block passage to most, if not all, of their historic spawning and rearing habitat. Given the circumstances, NMFS concluded in an earlier consultation that it is appropriate that harvest be managed to insure that hatchery escapement goals are met, thus protecting what remains of the genetic legacy of the ESU until such time that future planning efforts can lay out a more comprehensive solution leading to recovery (NMFS 1999a). The proposed fisheries will not limit the ability of the stocks to meet hatchery escapement goals. The hatchery escapement goals have been met in recent years. The anticipated return in 2001 is sufficient such that the goals are again likely to be met. Ocean fishery impacts have been reduced in recent years as a result of the recently completed Pacific Salmon Treaty (PST) agreement (NMFS 1999c). Terminal area tributary fisheries that might target unlisted surplus hatchery fish are not included as part of the state's proposed fisheries, but are managed specifically to meet hatchery escapement goals. NMFS expects that these tributary fisheries will be reviewed pursuant to the recent 4(d) Rule once anticipated applications are received from the states. Continued reliance on hatchery-origin fish for the survival of an important component of the LCR chinook ESU is not a satisfactory long-term solution. However, given the circumstances, the limited impacts that will occur pursuant to the proposed fisheries will have no detrimental affect on the species' prospects for survival and recovery. NMFS therefore concludes that fisheries managed in 2001, and in future years, as proposed and modified by the terms of the Interim Agreement are not likely to jeopardize the continued existence of the LCR chinook ESU.

8.1.3 Upper Willamette Spring Chinook Salmon

The anticipated harvest rate on UWR spring chinook in the proposed state fisheries is 10%. The ODFW is planning additional recreational fisheries in the Willamette River that are not included as part proposed fisheries considered here. However, ODFW recently submitted a Fishery Management and Evaluation Plan (FMEP) pursuant to the 4(d) Rule (65 FR 42422) that covers the expected take associated with all state mainstem and tributary fisheries. NMFS completed its review of the FMEP and determined that it adequately addresses all of the associated criteria (Darm 2001). Take prohibitions under section 9 of the ESA and applicable 4(d) rule therefore do not apply to fisheries, including those in the mainstem, that are managed consistent with the provisions of the FMEP.

Some additional fishing by the tribes may occur at Willamette Falls if flow conditions permit. In the past, optimal conditions have occurred only about once every 10 or 15 years. The average annual catch in the fishery is expected to be 21 fish, only about 10% of which would be listed fish. The expected catch in an optimal flow year is 300. The associated maximum harvest rate is expected to be no more than 0.5%. NMFS does not consider these limited and occasional impacts to be of consequence given the generally improving status of UWR spring chinook. NMFS therefore concludes that fisheries managed in 2001, and in future years, as proposed and modified by the terms of the Interim Agreement are not likely to jeopardize the continued existence of the UWR spring chinook ESU.

8.2 Steelhead

The majority of harvest impacts to listed steelhead ESUs occur in fall season fisheries. Although fall season fisheries are not part of the proposed action considered here, the anticipated impacts are considered by reviewing impacts associated with the 2000 fall season fisheries. The harvest rates from the winter, spring, and summer season fisheries are expected to range from 0.2% to 4.4% for listed natural-origin steelhead depending on the ESU (Table 14). Steelhead taken in non-Indian fisheries are taken primarily in selective fisheries targeting unlisted hatchery steelhead or other species. The states require that fishers release all steelhead caught in the commercial fisheries and all unmarked steelhead caught in recreational fisheries. Treaty Indian fisheries are generally not selective, but impacts have been reduced in recent years, primarily as a result of actions taken to protect other listed species. The catch of steelhead in the tribes' winter fishery, for example, has been all but eliminated in recent years. Prior to 1996 the catch of steelhead in the winter fishery was routinely several thousand fish per year (Speaks 2000). In the 2000 winter fishery no steelhead were caught and for 2001, through the week of February 25, only 45 steelhead have been caught in the fishery.

The maximum harvest rates shown in Table 14 are calculated to show the upper range of possible impacts. However, these are derived using assumptions that generally include time frames or assumptions when past management practices prevailed. Although harvest rates approaching the maximums reflected in Table 14 are conceivable, and may occur on occasion, they seem highly unlikely. NMFS expects harvest rates in future years to vary around the expected values. If the harvest rates approach the maximums in consecutive years, NMFS would reinitiate consultation to review its prior conclusions. For these reasons, NMFS focused on the expected harvest rates in coming to its conclusions in this opinion.

8.2.1 Lower Columbia River Steelhead

The expected harvest rate on LCR steelhead in the combined non-Indian and treaty Indian fisheries is 2.8%. Most of the ESU is located below Bonneville Dam and so only a portion of the ESU is affected by tribal fisheries. Impacts in non-Indian fisheries occur almost entirely incidental to their selective recreational fisheries targeting hatchery steelhead. Because the LCR steelhead are primarily winter run fish, they are subject to little additional harvest in fall season fisheries (1.8% in 2000, NMFS 2000c). Based on the available information, NMFS concludes that fisheries managed in 2001, and in future years, as proposed and modified by the terms of the Interim Agreement are not likely to jeopardize the continued existence of LCR steelhead.

8.2.2 Upper Willamette Steelhead

Upper Willamette River steelhead are winter run fish that are subject to very little harvest in these proposed fisheries or later fall season fisheries. The Willamette is a lower river tributary. Fish returning to the Willamette are therefore subject to relatively little harvest before they leave the mainstem Columbia River. The expected harvest rate is 0.2%. The impacts result from incidental catch in non-Indian mainstem fisheries directed at other species, and by a potential treaty Indian fishery at Willamette Falls that has had very limited impacts on steelhead in recent years (Speaks 2000). The only additional harvest would occur in recreational fisheries in the Willamette that are not specifically considered as part of this proposed action. These are selective fisheries that require the release of all unmarked, natural-origin fish. The extremely low impacts estimated here are not considered likely to jeopardize the continued existence of UWR steelhead. Based on the available information, NMFS concludes that fisheries managed in 2001, and in future years, as proposed and modified by the terms of the Interim Agreement are not likely to jeopardize the continued existence of UWR steelhead.

8.2.3 Mid-Columbia River Steelhead

Mid-Columbia River steelhead include both winter and summer run stocks. The expected harvest rate on MCR steelhead in the proposed fisheries is 4.0%, most of which will occur in the tribes' summer season fishery. Additional harvest impacts to the summer component will occur in the fall season fisheries. In 2000 the estimated fall season harvest rate on the ESU was 7.4% (NMFS 2000e). This was higher than in the prior year (5.7%) because of a relatively large return of URB fall chinook and a weak return of BPH fall chinook. This combination of circumstances tends to increase fishing effort in the fall season and thus the associated steelhead catch. The expected returns in 2001 are more like those in 1999 when the URB return was down and BPH return was generally stronger. This well tend to reduce impacts in the fall fisheries 2001 and probably reflects more typical circumstance that can be expected in the future.

Harvest rates on steelhead in the tribal fisheries have been reduced in recent years. Although we can not directly calculate the magnitude of the harvest rate reduction for this ESU in particular, it should be similar in magnitude to that of upriver A-run summer steelhead. The average harvest rate on wild A-run steelhead in the tribes' fall season fishery has declined by 47% since 1994.

In its listing notice NMFS cited particular concerns for winter run components of the ESU in the Klickitat and Fifteenmile Creek. Because of the timing of winter run steelhead, they are subject only to the proposed winter and spring season fisheries. The tribes' winter season fisheries have also been cut back substantially in recent years as it has changed in character from a steelhead and sturgeon fishery to a sturgeon target fishery. The catch of steelhead in the winter fishery declined from a 1991-1995 average of 2,800 to a 1996-1999 average of 242. The catch of steelhead in the 2000 winter fishery was 0 and is just 45 fish so far in the 2001 winter fishery. If steelhead catches in the winter fishery continue to be minimal, harvest impacts on the winter-run component of the ESU which occur primarily in the winter and spring season fisheries, will be less than the expect 4.0%.

Based on these considerations, NMFS concludes that fisheries managed in 2001, and in future years as proposed and modified by the terms of the Interim Agreement, are not likely to jeopardize the continued existence of MCR steelhead.

8.2.4 Snake River Steelhead

The expected harvest rate in the proposed fisheries is 2.9%, most of which will occur in the tribes' summer season fishery. The SRB steelhead ESU includes both A and B-run steelhead. The B-run steelhead (all of which are part of the Snake River steelhead ESU) were the component of greatest concern in recent consultations related to the fall season fisheries (NMFS 2000e). In that consultation, and in recent years, NMFS set a harvest rate limit on B-run steelhead for the fall season fisheries at 17%. The actual harvest rate in 2000 was 14.2%.

In the winter/spring/summer season fisheries considered here, impacts occur mostly to A-run steelhead, which are less critically depressed and experience lower harvest rates in fisheries later in the year. As noted above, the average harvest rate on wild A-run steelhead in the tribes' fall season fishery has declined by 47% since 1994 averaging 7.7 % in recent years.. B-run steelhead, which may be taken in the winter/spring/summer season, are likely primarily holdover fish from the previous run year which may have reduced reproductive value. NMFS expects that fall season fisheries where the majority of fishery impacts to SRB steelhead occur will continue to be subject to specific management constraints. Based on these considerations, NMFS concludes that fisheries managed in 2001, and in future years as proposed and modified by the terms of the Interim Agreement, are not likely to jeopardize the continued existence of SRB steelhead.

8.2.5 Upper Columbia River Steelhead

The expected harvest rates on listed natural and hatchery-origin UCR steelhead in the proposed fisheries are 4.4% and 7.2%, respectively. The higher harvest rates on hatchery-origin fish are not considered a risk to the species. Although the hatchery fish are listed and are integral to developing supplementation and recovery efforts, the hatchery fish are relatively abundant and generally exceed program needs that are designed to limit the proportional contribution of hatchery-origin fish. The fact that the recreational fisheries at least, can selectively reduce the abundance of hatchery fish may actually benefit the ESU in that it reduces the potential for straying and the need for subsequent efforts to balance broodstock contributions.

The anticipated harvest rate on natural-origin steelhead is lower, but also needs to be reviewed in the context of the stock's status, the environmental baseline, and other fishery impacts likely to occur later in the year. NMFS estimated that the anticipated harvest rates associated with the 2000 fall season fisheries would be about 10.9%. The actual harvest rate in 2000 was 4.0% and has averaged 7.7% since 1995 reflecting a 47% reduction from the prior ten year period.

As discussed in NMFS' 1999 fall season opinion (NMFS 1999b), the natural-origin component is depressed with returns at about 20% of their escapement goal. However, returns have been stable over the last six years. Smolt production has been close to or exceeded the production capacity of each of the four primary watersheds over the last ten years although much of the production is the result of hatchery strays. The high levels of smolt production, but low returns of natural-origin adults indicates that the productivity of the system is relatively low. The abundance of hatchery fish is, on the one hand, considered a risk to the species, but the fact that they are part of the ESU and listed indicates that they are also considered essential for recovery. Ongoing reforms to the hatchery and supplementation programs are designed to minimize the risks and maximize the benefits associated with the hatchery-origin steelhead. The availability of appropriate broodstock for supplementation purposes and the steps already taken to further diversify that broodstock and initiate supplementation programs help mitigate what would otherwise be an even greater concern regarding the status of the natural-origin fish.

The expected harvest rates on natural-origin fish in the winter/spring/summer season fisheries are 4.4%. Most of the expected catch (3.8%) occurs in the tribes' summer season fishery which has been stable in recent years. The fall season fisheries have been subject to greater reductions because of concerns for SR fall chinook and steelhead in particular. These stocks are likely to continue to be limiting with the result that the associated reduction in harvest on UCR steelhead in the fall season fisheries will continue. Because both the hatchery and natural-origin steelhead in the UCR ESU are listed, there are no fisheries for steelhead and thus few impacts to steelhead in the Upper Columbia River or its tributaries. Based on these considerations, NMFS concludes that fisheries managed in 2001, and in future years as proposed and modified by the terms of the Interim Agreement, are not likely to jeopardize the continued existence of UCR steelhead.

8.3 Sockeye Salmon

The expected harvest rate on SR sockeye salmon in the proposed fisheries is 5.0% based on recent year observations (Table 14). The proposed state and tribal fisheries are subject to a maximum harvest rate limit of 8.0%. Because of their migration timing, no additional impacts would be expected in the fall season fisheries.

The proposed fisheries will obviously reduce the number of returning sockeye in proportion to the expected harvest rate and indirectly future reproduction since there will be fewer potential spawners. (The distribution of the species will not be affected by the proposed fisheries.) It is therefore necessary to consider whether these reductions reduce the species likelihood of survival and recovery in the wild.

The All-H Paper and associated FCRPS opinion provide a context for considering proposed harvest actions. In these documents, NMFS articulates assumptions about mortalities and future survival improvements in each sector. NMFS also provides metrics and a schedule for checking those assumptions in the future. For harvest, it was assumed that mortality rates would be capped at or below levels established in recent biological opinions. For sockeye the 8% harvest cap is consistent with that expectation. The fact that the actual (and expected) harvest rate has averaged substantially less than 8% in recent years further reduces the associated risk.

Notwithstanding the standards established in the All-H Paper, the survival and recovery of SR sockeye depends on our ability to rebuild the runs from near-extinction levels and improve overall survival to the point that they become self-sustaining. The initial effort to rebuild the run depends primarily on the success of the captive broodstock and reintroduction program. Last year was the first year of substantial return from this experimental program. The return of SR sockeye to terminal areas in Idaho in 2000 was 257. The predicted return in 2001 is lower because there were fewer releases from the broodstock program (105 to the river mouth). However, returns will still be significantly above the cumulative total of returns in recent years (see Table 11). The broodstock program has demonstrated its ability to be self-generating and has accumulated a backlog of broodstock and juveniles that will now contribute a continuing stream of adult returns if the program continues to prove successful. The initial success helps establish that the captive broodstock program can be used to rebuild the run to the point that it can begin to establish a natural reproduction cycle. A necessary next step will be to evaluate whether the returning adults can spawn successfully with sufficient productivity to be self-sustaining.

The low level of harvest associated with the proposed fisheries does affect the ability of the broodstock program to contribute fish for release since it now generally operates at capacity. The proposed harvest rate is also too low to make a substantive difference in the number of returning adults. NMFS concludes that the prospects for future survival and recovery of SR sockeye is not appreciably reduced by the proposed fisheries. Based on these considerations, NMFS concludes that fisheries managed in 2001, and in future years as proposed and modified by the terms of the Interim Agreement, are not likely to jeopardize the continued existence of SR sockeye salmon.

8.4 Critical Habitat

Critical habitat has now been designated for all of the affected ESUs. While harvest activities do affect passage in that fish are intercepted, those impacts are accounted for explicitly in the preceding analyses regarding harvest related mortality. As discussed in section 6.0, other potential effects to critical habitat associated with the proposed fisheries are expected to be temporary and localized, particularly given the size and volume of the mainstem Columbia River where most of the proposed fisheries will occur. Impacts to critical habitat are expected to be negligible. Based on these considerations, NMFS concludes that the proposed fisheries will not result in the destruction or adverse modification of any of the essential features of the critical habitat in which these fisheries occur. For similar reasons the proposed action will not adversely affect EFH designated pursuant to the Magnuson-Stevens Act.

9.0 CONCLUSION

After reviewing the current status of listed salmon and steelhead in the Columbia River, the environmental baseline for the action area, the effects of the proposed non-Indian commercial and recreational fisheries, treaty Indian fisheries, the associated selective fisheries research activities and the cumulative effects, it is NMFS' biological opinion that fisheries managed in 2001, and in future years as proposed and modified by the terms of the Interim Agreement, are not likely to jeopardize the continued existence of SR spring/summer chinook, UCR spring chinook, LCR or UWR chinook salmon, SR sockeye salmon, or LCR, UWR, MCR, UCR, or SRB steelhead. The proposed fisheries are also not likely to destroy or adversely modify designated critical habitat.

10.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

The measures described below are non-discretionary; they must be undertaken by the action agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The action agencies have a continuing duty to regulate the activity covered in this incidental take statement. If the action agencies (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the agencies must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

10.1 Amount or Extent of the Take

NMFS anticipates that listed species will be taken as a result of winter, spring, and summer season fisheries managed in 2001 and in future years as proposed and modified by the terms of the Interim Agreement. The incidental take is expected to be in the form of catch and retention, or mortalities resulting from hooking and release, or mortalities resulting from encounter with fishing gear, as a consequence of fishery activities. The amount of take is described in terms of a harvest rate or the percent of the run taken for the combined treaty Indian and non-Indian fisheries.

UCR spring chinook and SR spring/summer chinook are expected to be the primary management constraints, in most years, for the mainstem fisheries in that they will define the upper limit of allowable harvest. For these ESUs, NMFS expects that the fisheries will be managed conservatively, but up to the specified limit of allowable harvest. In analyzing the anticipated effects for the other ESUs, NMFS considered both the outside limit of anticipated harvest rate (the maximum) and the expected harvest rates based on averages from recent years (Table 14). For these ESUs, NMFS used the maximum harvest rates to define the upper limit of allowable take in the ITS even though it is unlikely that the resulting harvest rates will be that high. Using the expected harvest rates would be inappropriate as an upper limit in an ITS since the actual harvest rate will presumably vary around the average.

The total harvest rate limit for natural-origin UCR spring chinook and the spring component of the SR spring/summer ESU in non-Indian and treaty Indian fisheries is defined by the harvest rate schedule shown in Table 13. Allowable harvest rates will be determined, both annually and inseason, depending on the applicable run sizes. For 2001, based on preseason run size information, the applicable harvest rate limits are 2% and 13% for the non-Indian and treaty Indian fisheries, respectively.

For all of the remaining ESUs the harvest rate limits for the treaty Indian fisheries are the maximums shown under the Treaty Indian Fisheries column in Table 14. No take of spring chinook from the LCR chinook ESU is anticipated. The harvest rate on the summer component of the SR spring/summer chinook ESU and UWR spring chinook will not exceed 5% and 0.5%, respectively. The harvest rate limit for SR sockeye in the tribal fisheries is 7%. Harvest rates for LCR steelhead, MCR steelhead, and SRB steelhead will not exceed 4.9%, 7.7%, and 5.7%, respectively. No take of UWR steelhead is expected. The harvest rate limits for UCR hatchery and natural-origin steelhead are 5.6% and 7.6%, respectively.

Except for UCR spring chinook and SR spring chinook, the anticipated harvest rate limits for the state fisheries are also summarized in Table 14. Harvest rates in the proposed state fisheries for LCR spring chinook will not exceed 12%. The harvest rate limits for SR summer chinook and sockeye salmon are both 1%. Harvest rates for natural-origin steelhead from the LCR, UWR, MCR, UCR, and SRB ESUs may not exceed 2%. The harvest rate limit for UCR hatchery-origin steelhead is 6%.

The expected impacts are based on the pre-season run size projection, provided for each run by the TAC. The TAC will update the runsize projections inseason as information from fisheries and dam counts becomes available. The actual number of listed fish which can be incidentally harvested will change accordingly. It is the applicable harvest rate limits, and not the number of listed fish, that defines the limit of allowable mortality in these fisheries. A post-season report, based on catch and the observed run size, will also be provided by TAC. Inseason monitoring will occur to ensure that fishery-specific impacts, possibly applied to inseason updates of the run-size projection, do not deviate substantially from expectation.

During this consultation, NMFS also considered the mortality that may occur associated with research, monitoring and evaluation activities that are designed to minimize incidental take resulting from implementation of selective fisheries. Mortality associated with the research and monitoring activities planned in 2001 is not expected to exceed a rate of 0.2% of natural-origin UCR or SR spring chinook, in particular, or other listed ESUs in general.

The research program being initiated in 2001 is intended to be the start of a multi-year effort. The research will presumably continue in future years during the term of this biological opinion. Mortality associated with the research will be kept to a minimum, but, in order to provide an upper limit of impacts, may not exceed an annual rate of 0.5% to any natural-origin component of a listed ESU.

10.2 Reasonable and Prudent Measures

The NMFS believes that the following reasonable and prudent measures are necessary and appropriate to minimize the take of salmon and steelhead listed under the ESA.

It is essential that inseason management actions taken during the course of the fisheries be consistent with the management objectives described in state's section 10 permit application and the tribes' biological assessment (Tweit and Norman 2000 and Speaks 2000) as modified by the above described Reasonable and Prudent Alternative. In order to implement these measures, it is necessary to monitor both run size and catch during the season. Information on stock composition is necessary to assess impacts on listed fish, and provide timely indications of changes in the assumptions about species proportions, conversion rates, and age compositions used to develop these harvest objectives. To assure conformity with the specified harvest rates and to provide information necessary for monitoring stock utilization and performance, the following reasonable and prudent measures are established.

1. ODFW, WDFW, and the member tribes of Columbia River Intertribal Fish Commission (tribes) shall manage their fisheries to minimize harvest impacts to listed salmonids.

2. Parties to the Interim Agreement shall provide preseason information necessary to manage the winter, spring, and summer season fisheries as proposed.

3. Parties to the Interim Agreement shall monitor salmonid passage at Columbia River dams, and TAC shall provide updates to run size projections.

4. ODFW and WDFW shall monitor the catch for all Zone 1-5 commercial and recreational fisheries, and Zone 6 commercial fisheries. The tribes shall monitor the catch of all Zone 6 C&S and experimental shad fisheries.

5. Shad test fisheries shall be structured in such a way as to minimize delay of passage by salmonids. These fisheries shall be monitored in such a way as to provide timely information on such possible delays.

6. Parties to the Interim Agreement shall implement a research, monitoring, and evaluation program to further develop selective fishery strategies to reduce impacts to listed fish and provide alternative harvest opportunities. Results from all research, monitoring, and evaluation work done in conjunction with the development and assessment of selective fisheries shall be reported to NMFS by the tribe or management agency conducting the activity.

10.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the action agencies must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. ODFW, WDFW, and the member tribes of CRITFC shall manage their fisheries to keep harvest rates within the above described limits, based on TAC's preseason projections of run size and any subsequent inseason updates.

2. The parties to the Interim Agreement are responsible for providing preseason forecasts of run size necessary to manage the winter, spring, and summer season fisheries as proposed. These shall be provided annually to NMFS by the TAC by December 15 of each year.

ODFW, WDFW, and the BIA shall also provide to NMFS annually a Table equivalent to Table 14 in this opinion that reports the expected total mortality rates in state and tribal fisheries for each listed ESU. The Table shall be provided to NMFS by December 15 of each year and will be used to assess continued compliance with the proposed action.

3. Parties to the Interim Agreement shall monitor dam counts and other available information to develop inseason updates to run size estimates for upriver spring, summer chinook, and sockeye salmon. All revisions to preseason information shall be report to NMFS by TAC as they

become available. The inseason information is necessary to ensure continued compliance with the proposed action.

4. Monitoring of catch in all Zone 1-5 fisheries by ODFW and WDFW shall be sufficient to provide statistically-valid estimates of the salmonid catch. Sampling of the commercial catch shall include daily contact with buyers regarding the catch of the previous day. The recreational fishery shall be sampled using effort surveys and suitable measures of catch rate. Monitoring of catch in the Zone 6 fisheries by the treaty tribes and ODFW and WDFW shall be sufficient to provide statistically-valid estimates of the salmonid catch. The catch monitoring program shall be stratified to include platform, hook-and-line, gillnet, and test fishery components.

Results from the catch monitoring will be reported to NMFS by TAC periodically as necessary to ensure that the catch remains within the prescribed harvest rate limits. Periodically may mean weekly or more often during active fishing periods.

The TAC shall account for the catch of each fishery as it occurs through the season. If it becomes apparent inseason that any of the established harvest rate limits may be exceeded due to catch or revisions in the run-size projection, then the states and tribes shall take additional management measures to reduce the anticipated catch as needed to conform to the limits.

Monitoring of catch-and-release fisheries shall include records of the condition of salmonids released, where possible, to help assess overall mortalities for these fisheries.

5. ODFW, WDFW, and the treaty tribes shall ensure that shad experimental fisheries are devised in ways such that indirect effects not accounted for in the harvest rate ceilings, such as passage delay, are negligible. Treaty and non-treaty shad fisheries shall be adequately monitored to account for all salmonid impacts. Before fisheries take place in or near dam passage facilities, a proposal for each fishery shall be coordinated through NMFS, the U.S. Army Corps of Engineers (USACE), and the Fish Passage Advisory Committee (FPAC). Nets used in shad fisheries shall not occlude more than the top half of the water column, nor shall they substantially obstruct any exit from adult fish passage routes. No shad fishery shall occur within any operating adult salmon fishway. Monitoring of shad fisheries shall be sufficient to detect, on a timely basis, the impedance of adult salmonid passage. Methods to evaluate such impedance require development, but may include information from radio-tagging studies, dam counts, or other direct observations. Descriptions of proposed shad fisheries shall include specific adult passage delay evaluation methods. If noticeable passage delay occurs as a result of experimental shad fisheries, those fisheries shall be suspended, or altered in such a way as to eliminate passage delay. Such fishery alterations shall also be reviewed by NMFS, the USACE, and FPAC, and approved by NMFS.

6. The development and implementation of selective fishing methods provides a means to further minimize the incidental take of listed fish. Research, monitoring, and evaluation activities are necessary to develop and assess new selective fishing techniques. The activities also are needed to determine how the gear can be used to maximize catch and minimize the associated incidental mortality of released fish. A further objective is to measure the associate handling mortality so that the effects of using the gear can be correctly assessed. To be useful,

the information gathered must be reported and synthesized in an organized manner. The results from all such activities shall therefore be reported to NMFS by TAC which will serve a reporting and coordination function in this regard. The state, tribe, or other entity responsible for each assessment activity shall provide an initial summary of its results to TAC and NMFS within one month of the completion of the associated field work. TAC must then provide to NMFS an annual summary of the results from all related projects by October 31 of each year.

NMFS believes that incidental take resulting from the proposed fisheries will be no greater than described in section 10.1, above. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The agencies must immediately provide an explanation of the causes of the excess taking, and review with the NMFS the need for possible modification of the reasonable and prudent measures.

11.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop additional information. NMFS believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented:

1. It would be useful to have a method for updating the expected return of natural-origin spring chinook inseason so that harvest can be more responsive to the status of the stock. NMFS therefore recommends that TAC explore the options for developing such a method.

2. The harvest rate schedule in Table 13 identifies abundance levels for the SR spring chinook and UCR spring chinook that are used as indicators of stock status for the purpose of setting target harvest rates. NMFS should review the abundance levels used in the harvest rate schedule and develop similar indicators for other key stocks that can be used as bench marks for considering future fishery proposals. Guidance provided in the VSP paper should be used to help set critical and recovery abundance targets.

3. For the most part, listed salmonids passing through the Columbia River mainstem upstream of Bonneville Dam during the winter, spring, and summer represent natural-origin fish. With the exception of the Wells Hatchery stock of Upper Columbia River steelhead and some SR chinook stocks, salmonids of hatchery-origin are unlisted. The Columbia River treaty tribes should explore the feasibility of regulations requiring live release of unmarked salmonids in their dip net and hoop net fisheries. The catch-and-release mortality rates for these fishery techniques is unknown but thought to be quite low, possibly approaching 1%. The live release of unmarked salmonids, especially steelhead, may provide a tool for decreasing impacts to listed fish and allow for meaningful and possibly increased harvest opportunity.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

12.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the Interim Agreement related to proposed treaty Indian and non-Indian winter, spring, and summer season fisheries. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take specified in the Incidental Take Statement is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect on to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, section 7 consultation must be immediately reinitiated.

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